## **Environmental Chemical Corporation**

## Li Tungsten

#### STANDARD LEVEL IV REPORT OF ANALYSIS

**WORK ORDER #07-07017-OR** 

July 19, 2007

EBERLINE SERVICES/OAK RIDGE LABORATORY OAK RIDGE, TN

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### STANDARD OPERATING PROCEDURE

Sample Receiving

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## Eberline Services -- Oak Ridge Laboratory LABORATORY DATA SUPPORT CHECKLIST

MP-001-3

Eberline Services Work Order #	97	•	0	7	0	1	7	

The checklist items listed below are to be initialed by appropriate staff upon completion/verification.

Date for Partial	Initials	Date	Initials	Checklist Items
		7-5-07	00	Sample Log-In
		7/13/07	KRS	Data Compilation
		7-1607	1 LT	Technical Data Review May 14
		7/19/67	08	Data Entry/Electronic Deliverable
		7/19/02	08	Case Narrative
		7/19/07	KBS	Electronic Deliverable Proof
		1/19/01	WH	Samples Analyzed within Holding Time
		7119/07	10.H.	QA/QC Review
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# SECTION I CHAIN OF CUSTODY

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Lakewood, CO 80401 Phone: (303) 298-7607							COC Mumber			1
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Contact: Theodore Johnson Phone: (303) 472 - 8834		- - -					Phone: (614) 402 - 2020 Customer Project Name	Phone: (614) 402 - 2020 Customer Project Name: Li Tungsten	fungsten	
Fax: (516) 665-8531	·		-							20
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Work Order #	07-07017
Lab Deadline	7/26/2007
Analysis	UUISO - Level 4
Sample Matrix	Soil/Solid

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Work Order #	07-07017
Lab Deadline	7/26/2007
Analysis	ThiSO - Level 4
Sample Matrix	Soil/Solid

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Work Order #	07-07017
Lab Deadline	7/26/2007
Analysis	Ra226 - Level 4
Sample Matrix	Soil/Solid

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Work <b>Or</b> der #	07-07017
Lab <b>De</b> adline	7/26/2007
Analysis	Ra228 - Level 4
Sample Matrix	Soil/Solid

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
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# SECTION II SAMPLE ACKNOWLEDGEMENT

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## STANDARD OPERATING PROCEDURE

Sample Receiving

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#### Eberline Services - Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST MP-001-2

SAMPLE MATRIX/MATRICES:	(CIRCI	LE ONE	OR BOTH)	
	AQUE	ous .	NON-AQU	EOU8
WERE SAMPLES:	(CIRC	LE EITH	ER YES, NO	), OR N
Received in good condition?	0	IN		
If aqueous, properly preserved	Υ	N	NIA	7
VERE CHAIN OF CUSTODY SEALS:	<del></del>	<b>!</b>		<b> </b>
Present on outside of package?	0	N		
Unbroken on outside of package?	Ø	N		,
Present on samples?	0	N		
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# SECTION III CASE NARRATIVE



EBS-OR-26044

July 19, 2007

Ted Johnson **Environmental Chemical Corporation** 63 Herb Hill Road Glen Cove, NY 11542

Oak Ridge Laboratory 601 Scarboro Road Oak Ridge, TN 37830 Phone (865) 481-0683 Fax (865) 483-4621

#### CASE NARRATIVE Work Order # 07-07017-OR

#### SAMPLE RECEIPT

This work order contains one soil sample received 7/5/2007. This sample was analyzed for Radium-226/228, Isotopic Thorium and Isotopic Uranium.

**CLIENT ID** 

LAB ID

5601-FSS-SU3-1014

07-07017-04

#### ANALYTICAL METHODS

Radium-226 was analyzed using EPA Method 903.0 Modified. Radium-228 was analyzed using EPA Method 904.0 Modified. Isotopic Thorium was analyzed using Method EML Th-01 Modified. Isotopic Uranium was analyzed using Method EML U-02 Modified.

#### ANALYTICAL RESULTS

Combined Standard uncertainty is reported at 1-sigma value.

Method Detection Limits (MDA's) reflected on the Preliminary Data Report (PDR) are calculated using the equation from ANSI N13.30 (see below) for different blank and sample counting times. The MDA calculation used by the alpha spectroscopy software assumes an equal count time for the sample and background, and may be therefore slightly different than the MDA reflected on the PDR.

ANSI 13.30 MDA = 
$$\frac{3.29\sqrt{R_b T_g \left(1 + \frac{T_g}{T_b}\right)} + 3}{K T_b}$$

R<sub>b</sub> = Background Count Rate

 $T_g$  = Count Time of Sample  $T_b$  = Background Count Time

K = Calibration and Calculation Factors in

Appropriate Units

#### ISOTOPIC URANIUM

Sample was prepared by removing a representative aliquot from the sample followed by mixed acid digestions as appropriate. Uranium was selectively extracted by ion exchange. Uranium was eluted, micro-precipitated and mounted on micro-porous filter media. Sample activities were then determined by alpha spectroscopy using energy specific regions of interest for Uranium-234, Uranium-235 and Uranium-238. Chemical recovery was determined by the use of a Uranium-232 tracer. Activity of the Uranium-232 tracer was determined by alpha spectroscopy using an energy specific region of interest.

#### ANALYTICAL RESULTS CONTINUED

#### **ISOTOPIC URANIUM continued**

Sample demonstrated background equivalent results for Uranium-234, Uranium-235 and Uranium-238 activity. Chemical recovery was acceptable for all samples. Results for the Uranium-234, Uranium-235 and Uranium-238 method blank demonstrated background or non-detect equivalent activity. Results for the Uranium-234 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Uranium-235 replicate demonstrated a high relative percent difference and normalized difference. Uranium-235 replicate results are statistically equivalent with consideration of the ±2-sigma counting uncertainties. Results for the Uranium-238 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Uranium-234, Uranium-235 and Uranium-238 laboratory control sample demonstrated an acceptable percent recovery.

#### ISOTOPIC THORIUM

Sample was prepared by removing a representative aliquot from the sample followed by mixed acid digestions as appropriate. Thorium was selectively extracted by ion exchange. Thorium was eluted, micro-precipitated and mounted on micro-porous filter media. Sample activities were then determined by alpha spectroscopy using energy specific regions of interest for Thorium-228, Thorium-230 and Thorium-232. Chemical recovery was determined by the use of a Thorium-229 tracer. Activity of the Thorium-229 tracer was determined by alpha spectroscopy using an energy specific region of interest.

Sample demonstrated slightly positive results for Thorium-228, Thorium-230 and Thorium-232 activity. Chemical recovery was acceptable for all samples. Results for the Thorium-228, Thorium-230 and Thorium-230 method blank demonstrated background equivalent activity. Results for the Thorium-228 and Thorium-230 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Thorium-232 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Thorium-230 and Thorium-232 laboratory control sample demonstrated an acceptable percent recovery.

#### RADIUM-226

Sample was prepared by removing a representative aliquot from the sample followed by mixed acid digestions as appropriate. This was followed by selective sulfate precipitations of the Radium. Samples were then mounted by semi-micro-precipitations onto micro-porous filters. Samples were counted by alpha spectroscopy using an energy specific region of interest for Radium-226. Chemical recovery was calculated by the use of a Barium-133 tracer, which was determined by HPGe gamma spectroscopy.

Sample demonstrated slightly positive results for Radium-226 activity. Chemical recovery was acceptable for all samples. Results for the Radium-226 method blank demonstrated background equivalent activity. Results for the Radium-226 replicate demonstrated a slightly high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Radium-226 laboratory control sample demonstrated an acceptable percent recovery.

#### RADIUM-228

Following alpha spectroscopy analysis of Radium-226, Barium/Radium Sulfate precipitate was redissolved and allowed for sufficient ingrowth of the Actinium-228 daughter. After ingrowth, Actinium-228 was selectively precipitated. Precipitate was filtered and Actinium-228 beta emissions were then

#### ANALYTICAL RESULTS CONTINUED

#### RADIUM-228 continued

counted on a gas proportional counter. Chemical recovery was determined by the use of a Barium-133 tracer, of which each sample activity was determined by HPGe gamma spectroscopy and an elemental Yttrium carrier by gravimetric measurements. The product of these two recoveries was used to calculate chemical yield.

Sample demonstrated background equivalent results for Radium-228 activity. Chemical recovery was acceptable for all samples. Results for the Radium-228 method blank demonstrated background equivalent activity. Results for the Radium-228 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Radium-228 laboratory control sample demonstrated an acceptable percent recovery.

#### **CERTIFICATION OF ACCURACY**

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall Laboratory Manager

Date: 7/19/2007

# SECTION IV ANALYTICAL RESULTS SUMMARY

Pline Services   Client Ocove, NY 11642   Analysis Category:   Category Ocover					Report To:				4	Work Order Details:	ils:		
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63 Herb Hill Road         Analysis         Category:         Sample Date         Analysis         Batch Date         Analysis         Batch Date         Batch Date         Date <t< th=""><th></th><th>יני סניו אוכנים</th><th>Li Tung</th><th>sten Su</th><th>Serfund S</th><th>ite</th><th>***************************************</th><th>Purchase Order:</th><th>5601.</th><th>5601.000.ES</th><th>***************************************</th><th></th><th></th></t<>		יני סניו אוכנים	Li Tung	sten Su	Serfund S	ite	***************************************	Purchase Order:	5601.	5601.000.ES	***************************************		
Sample         Receipt         Analysis         Batch         Analyte         Method           07/05/07 00:00         7/5/2007         7/10/2007         07-07017         Radium-226         EPA 903.0 Modified           07/05/07 00:00         7/5/2007         7/10/2007         07-07017         Radium-226         EPA 903.0 Modified           07/05/07 00:00         7/5/2007         7/10/2007         07-07017         Radium-226         EPA 903.0 Modified           05/25/07 00:00         7/5/2007         7/10/2007         07-07017         Radium-226         EPA 903.0 Modified           05/25/07 00:00         7/5/2007         7/10/2007         07-07017         Radium-226         EPA 903.0 Modified           05/25/07 00:00         7/5/2007         7/10/2007         07-07017         Radium-226         EPA 903.0 Modified           07/05/07 00:00         7/5/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           07/05/07 00:00         7/5/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           06/25/07 00:00         7/5/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           07/05/07 00:00         7/5/2007         7/12/2007         07-07017	Final Rep	ort of Analysis	63 Herk	Hill Ros	p			Analysis Category:	ENSE	ENVIRONMENTAL	.AL		
Sample         Client         Sample         Reckly         Analysis         Brth         Analysis         Brth         Analysis         Brth         Analysis         Brth         Analysis         Method           LCS         KNOVMN         0770507 0000         7762007         7702007         7702007         7707017         Radium-226         EPA 903.0 Modified           LCS         SPIKE         0770507 0000         7762007         7702007         7702007         7707017         Radium-226         EPA 903.0 Modified           DD         5601-FSS-SU3-1014         6972607 0000         7762007         77102007         07-7017         Radium-226         EPA 903.0 Modified           DD         5601-FSS-SU3-1014         6972607 0000         7752007         77102007         07-7017         Radium-226         EPA 904.0 Modified           LCS         KNOWN         0776507 0000         7752007         77132007         07-7017         Radium-228         EPA 904.0 Modified           LCS         SPIKE         0776507 0000         7752007         77132007         07-7017         Radium-228         EPA 904.0 Modified           LCS         SPIKE         0776507 0000         7762007         77132007         77-7017         Radium-228         EPA 904.0 Modified<			Glen Co		1542			Sample Matrix:	SO				
LCS   KNOWN   O7/05/07 00:00   7/15/2007   7/10/2007   Radium-226   EPA 90.3 0 Modified			Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	ກວ	nso	MDA	Report Units
LCS         SPIKE         O7/05/07 00:00         7/8/2007         7/11/2007         7/11/2007         Reduim-226         EPA 90:0 Modified           DUP         6601-FSS-SU3-1014         06/25/07 08-46         7/8/2007         7/11/2007         7/11/2007         Reduim-226         EPA 90:0 Modified           DUP         6601-FSS-SU3-1014         06/25/07 08-46         7/8/2007         7/11/2007         7/11/2007         Reduim-226         EPA 90:0 Modified           LCS         KNOWN         07/05/07 06-00         7/8/2007         7/11/2007         7/11/2007         Reduim-228         EPA 90:0 Modified           LCS         SPIKE         07/05/07 00:00         7/8/2007         7/11/2007         7/11/2007         Reduim-228         EPA 90:0 Modified           DUP         6601-FSS-SU3-1014         06/25/07 00:00         7/8/2007         7/11/2007         7/11/2007         Reduim-228         EPA 90:0 Modified           DUP         6601-FSS-SU3-1014         06/25/07 00:00         7/8/2007         7/11/2007         7/11/2007         Reduim-228         EPA 90:0 Modified           LCS         SPIKE         07/05/07 00:00         7/8/2007         7/11/2007         7/11/2007         7/11/2007         Reduim-228         EPA 90:0 Modified           LCS         SPIKE	-	-	00:00 20/02/01	7/5/2007	7/10/2007	07-07017	Radium-226	EPA 903.0 Modified	1.01E+01	4.66E-01			pCi/g
MBL         BLANK         OT/05/07 00:00         7/5/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         PRA 90.0 Modified         EPA 90.0 Modified           DD         5601-FSS-SU3-1014         05/25/07 08-45         7/5/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         7/10/2007         PRA 90.0 Modified           LCS         KNOWIN         07/05/07 00:00         7/5/2007         7/10/2007         07/10/2007         7/10/2007	-	-	07/05/07 00:00	7/5/2007	7/10/2007	07-07017	Radium-226	EPA 903.0 Modified	1.06E+01	1,39E+00	7.10E-01	2.16E-01	pCi/g
DUP         5601-FSS-SU3-1014         05/25/07 09-45         7/10/2007         7/10/2007         07-07/017         Radium-226         EPA 903.0 Modified           LCS         KNOWN         07/05/07 00:00         7/15/2007         7/13/2007         7/13/2007         07-07/017         Radium-228         EPA 903.0 Modified           LCS         SPIKE         07/05/07 00:00         7/15/2007         7/13/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           LCS         SPIKE         07/05/07 00:00         7/15/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           DUP         5601-FSS-SU3-1014         65/25/07 00:00         7/15/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           LCS         KNOWN         07/05/07 00:00         7/15/2007         7/13/2007         7/13/2007         7/10/17         Radium-228         EPA 904.0 Modified           LCS         KNOWN         07/05/07 00:00         7/15/2007         7/12/2007         7/10/17         7/10/17         Radium-228         EPA 904.0 Modified           LCS         KNOWN         07/05/07 00:00         7/15/2007         7/12/2007         7/10/17         7/10/17         RADIUM-228         EML Th-01	-		07/05/07 00:00	7/5/2007	7/10/2007	07-07017	Radium-226	EPA 903.0 Modiffied	5.14E-02	1.01E-01	5.14E-02	2.87E-01	pCi/g
DO         5601-FSS-SU3-1014         05/25/07 09-45         7/16/2007         7/10/2007         07-07017         Radium-228         EFA 903.0 Modified           LCS         SNOWN         07/05/07 00:00         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           LCS         SPIKE         07/05/07 00:00         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:04         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:04         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           LCS         KNUOWN         07/05/07 00:00         7/15/2007         7/12/2007         07-07017         Thoffun-228         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/15/2007         7/12/2007         07-07017         Thoffun-228         EML Th-01 Modified           LCS         KNUOWN         07/05/07 00:00         7/15/2007         7/12/2007         07-07017         Thoffun-228         EML Th-01 Modified           LCS         KNUOWN         07/05/07 00:00	_	_	05/25/07 09:45	7/5/2007	7/10/2007	07-07017	Radium-226	EPA 903.0 Modified	7.71E-01	2.92E-01	1.49E-01	2.41E-01	pCi/g
LCS         KNOWN         O705607 00:00         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           LCS         SPHCE         07/05/07 00:00         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           MBL         BLANK         07/05/07 00:00         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           DO         5601-FSS-SUS-1014         05/25/07 08-45         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           LCS         KNOWN         07/05/07 00:00         7/15/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           LCS         SPIKE         07/05/07 00:00         7/15/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/15/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/12/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/12/2007			05/25/07 09:45	7/5/2007	7/10/2007	07-07017	Radium-226	EPA 903.0 Modified	1.01E+00	3.31E-01	1.69E-01	2.21E-01	pCi/g
LCS         KNOWN         O7/05/07 00:00         7/5/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           LCS         SFINEE         O7/05/07 00:00         7/15/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           DUP         5601-FSS-SUS-1014         06/25/07 09:46         7/15/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           DD         5601-FSS-SUS-1014         06/25/07 09:46         7/15/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           DD         5601-FSS-SUS-1014         06/25/07 09:46         7/15/2007         7/13/2007         07-07/017         Radium-228         EPA 904.0 Modified           LCS         KNOWN         07/05/07 00:00         7/15/2007         7/12/2007         07-07/017         Thorium-228         EML Th-01 Modified           DUP         5601-FSS-SUS-1014         06/25/07 09:45         7/15/2007         7/12/2007         07-07/017         Thorium-228         EML Th-01 Modified           DD         5601-FSS-SUS-1014         06/25/07 09:46         7/15/2007         7/12/2007         07-07/017         Thorium-228         EML Th-01 Modified           LCS         KNOWN <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>													
LCS         SPIIKE         07/05/07 00:00         7/15/2007         7/13/2007         7/			00:00 20/50/20	7/5/2007	7/13/2007	07-07017	Radium-228	EPA 904.0 Modified	3.79E+01	1.71E+00			. bCi/g
MBL         BLANK         O7705/07 00:00         715/2007         71/3		_	00:00 20/50/20	7/5/2007	7/13/2007	07-07017	Radium-228	EPA 904.0 Modified	3.30E+01	1.13E+00	1.18E+00	1.03E+00	pCi/g
DUP         5601-FSS-SU3-1014         05/25/07 09-45         7/5/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           LCS         KNUWNN         05/25/07 09-45         7/5/2007         7/13/2007         07-07017         Radium-228         EPA 904.0 Modified           LCS         KNUWNN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-228         EMI Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-228         EMI Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-228         EMI Th-01 Modified           LCS         KNUWN         07/05/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-238         EMI Th-01 Modified           LCS         KNUWN         07/05/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-230         EMI Th-01 Modified           LCS         KNUWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EMI Th-01 Modified           LCS         KNUWN         07/05/07 00:00 <td< td=""><td></td><td></td><td>00:00 20/50/20</td><td>7/5/2007</td><td>7/13/2007</td><td>07-07017</td><td>Radium-228</td><td>EPA 904.0 Modified</td><td>3.44E-01</td><td>4.42E-01</td><td>2.26E-01</td><td>1.04E+00</td><td>pCi/g</td></td<>			00:00 20/50/20	7/5/2007	7/13/2007	07-07017	Radium-228	EPA 904.0 Modified	3.44E-01	4.42E-01	2.26E-01	1.04E+00	pCi/g
DO         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/13/2007			05/25/07 09:45	7/5/2007	7/13/2007	07-07017	Radium-228	EPA 904.0 Modified	3.23E-01	3.89E-01	1.99E-01	9.17E-01	pCi/g
LCS SPIKE 07/05/07 00:00 7/5/2007 7/12/2007 Thorium-228 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 Thorium-239 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 Thorium-230 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 Thorium-230 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 Thorium-230 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 7/12/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/05/07 00:00 7/5/2007 07/07/07 Thorium-232 EML Th-01 Modified 07/07/07/07 Thorium-232 EML Th-01 Modified 07/07/07 Thorium-232 EML Th-01 Modified 07/07/07 Th-01 Modif			05/25/07 09:45	7/5/2007	7/13/2007	07-07017	Radium-228	EPA 904.0 Modified	6.29E-01	3.28E-01	1.69E-01	7.35E-01	pCi/g
LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07/017         Thorium-228         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07/017         Thorium-228         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07/017         Thorium-228         EML Th-01 Modified           DD         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07/017         Thorium-228         EML Th-01 Modified           LCS         KNOWN         07/05/07 09:45         7/5/2007         7/12/2007         07-07/017         Thorium-238         EML Th-01 Modified           LCS         SPIKE         07/05/07 09:00         7/5/2007         7/12/2007         07-07/017         Thorium-230         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07/017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 09:45         7/5/2007         7/12/2007         07-07/017         Thorium-230         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00													
LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12			07/05/07 00:00	7/5/2007	7/12/2007	07-07017	Thorium-228	EML Th-01 Modified	4.76E+00	1.71E-01			pCi/g
MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DUP         S601-FSS-SU3-1014         05/25/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00 <td< td=""><td></td><td></td><td>07/05/07 00:00</td><td>7/5/2007</td><td>7/12/2007</td><td>07-07017</td><td>Thorium-228</td><td>EML Th-01 Modified</td><td>4.97E+00</td><td>1.14E+00</td><td>5.82E-01</td><td>1.40E-01</td><td>pCi/g</td></td<>			07/05/07 00:00	7/5/2007	7/12/2007	07-07017	Thorium-228	EML Th-01 Modified	4.97E+00	1.14E+00	5.82E-01	1.40E-01	pCi/g
DUP         5601-FSS-SU3-1014         05/25/07 09-45         7/5/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09-45         7/5/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09:04         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 09:04         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         SPIKE         07/05/07 09:05         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00			00:00 40/50/40	7/5/2007	7/12/2007	07-07017	Thorium-228	EML Th-01 Modified	1.23E-01	1.36E-01	6.93E-02	2.16E-01	pCi/g
DO         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-228         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         05/25/07 09:04         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 09:04         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         07/05/07 00:00			05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Thorium-228	EML Th-01 Modified	7.57E-01	2.87E-01	1.46E-01	1.67E-01	pCi/g
LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:05         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         07/05/07 00:00			05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Thorium-228	EML Th-01 Modified	8.69E-01	2.99E-01	1.53E-01	1.16E-01	pCi/g
LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09:05         7													
LCS   SPIKE   D705/07 00:00   7/5/2007   7/12/2007   Thorium-230   EML Th-01 Modified			00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Thorium-230	EML Th-01 Modified	5.32E+00	1.44E-01			pCi/g
MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07/017         Thorium-230         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified			02/02/07 00:00	7/5/2007	7/12/2007	07-07017	Thorium-230	EML Th-01 Modified	5.41E+00	1.23E+00	6.26E-01	1.01E-01	pCi/g
DUP         5601-FSS-SU3-1014         05/25/07 09.45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09.45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified			07/05/07 00:00	7/5/2007	7/12/2007	07-07017	Thorium-230	EML Th-01 Modified	1.46E-01	1.36E-01	6.92E-02	1.60E-01	pCi/g
DO         5601-FSS-SU3-1014         05/25/07 09.45         7/5/2007         7/12/2007         07-07017         Thorium-230         EML Th-01 Modified           LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified			05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Thorium-230	EML Th-01 Modified	8.56E-01	3.01E-01	1.54E-01	1.02E-01	pCi/g
LCS KNOWN 07/05/07 00:00 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SPIKE 07/05/07 00:00 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SPIKE 07/05/07 00:00 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 7/12/2007 07-07017 Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/07 09-45 7/5/2007 07-07017 Th-01 Modified CLS SE01-FSS-SU3-1014 05/25/			05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Thorium-230	EML Th-01 Modified	7.90E-01	2.75E-01	1.40E-01	9.44E-02	pCi/g
LCS         KNOWN         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 09:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified	-								.1				
LCS         SPIKE         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 08:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DO         5601-FSS SU3-1014         05/25/07 08:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified			00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Thorium-232	EML Th-01 Modified	4.76E+00	1.71E-01			pCi/g
MBL         BLANK         07/05/07 00:00         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DUP         5601-FSS-SU3-1014         05/25/07 08:45         7/5/2007         7/12/2007         07-07017         Thorium-232         EML Th-01 Modified           DO         5601-FSS-SU3-1014         05/25/07 06:45         7/5/2007         7/19/2007         07-07017         Thorium-232         EMI Th-01 Modified			00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Thorium-232	EML Th-01 Modified	5.34E+00	1.21E+00	6.18E-01	1.01E-01	pCi/g
DUP 5601-FSS-SU3-1014 05/25/07 08:45 7/5/2007 7/12/2007 07-07017 Thorium-232 EML Th-01 Modified			00:00 20/02/04	7/5/2007	7/12/2007	07-07017	Thorium-232	EML Th-01 Modified	3.95E-02	7.72E-02	3.94E-02	1.60E-01	pCi/g
DO 5604-ESC.S12-1014 05/05/07 00-45 7/5/2007 7/1/2/2007 07-07017 Thorium-232 EMI Th.01 Modified			05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Thorium-232	EML Th-01 Modified	6.03E-01	2.39E-01	1.22E-01	9.17E-02	pCi/g
5001-F-50-505-1014 00/20/07 08:45 1/2/2007 1/12/2007 1/10/20/07 1/	07-07017-04 DO	5601-FSS-SU3-1014	05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Thorium-232	EML Th-01 Modified	8.43E-01	2.86E-01	1.46E-01	4.23E-02	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original



# Oak Ridge Laboratory 865/481-0683 FAX 865/483-4621

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					Report To:				Ŋ	Work Order Details:	vils:		
T T T T T T T T T T T T T T T T T T T	Juli-	Eberline Services	Ted Johnson	nosuu				SDG:	0-20	07-07017			:
		י סכו אוכנים	Li Tungsten S	Isten Sul	uperfund Site	ite		Purchase Order:	5601.(	5601.000.ES	***************************************		
Final	Repo	Final Report of Analysis	63 Hert	63 Herb Hill Road	pı			Analysis Category:	ENVIF	ENVIRONMENTAL	<sup>T</sup> AL		
	•	-	Glen Cove, NY		11542			Sample Matrix:	SO				
Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	ਫ	กรว	MDA	Report Units
07-07017-01	SOT	KNOWN	00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Uranium-234	EML U-02 Modified	8.22E+00	2.96E-01			pCi/g
07-07017-01	SOT	SPIKE	07/05/07 00:00	7/5/2007	7/12/2007	07-07017	Uranium-234	EMIL U-02 Modiffed	7.63E+00	1.29E+00	6.58E-01	6.30E-02	pCi/g
07-07017-02	MBL	BLANK	00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Uranium-234	EML U-02 Modified	1.04E-01	7.41E-02	3.78E-02	6.54E-02	pCi/g
07-07017-03	DOP	5601-FSS-SU3-1014	05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Uranium-234	EML U-02 Modified	6.08E-01	1.82E-01	9.27E-02	4.78E-02	pCi/g _
07-07017-04	8	5601-FSS-SU3-1014	05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Uranium-234	EML U-02 Modified	5.82E-01	1.83E-01	9.36E-02	7.80E-02	pCi/g
07-07017-01	SOT	KNOWN	00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Uranium-235	EML U-02 Modified	3.73E-01	1.34E-02			pCi/g
07-07017-01	SOT	SPIKE	00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Uranium-235	EML U-02 Modified	3.36E-01	1.58E-01	8.07E-02	4.55E-02	pCi/g
07-07017-02	MBL	BLANK	00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Uranium-235	EML U-02 Modified	2.98E-02	4.23E-02	2.16E-02	4.03E-02	pCI/g
07-07017-03	aUG.	5601-FSS-SU3-1014	05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Uranium-235	EML U-02 Modified	1.90E-02	3.69E-02	1.88E-02	7.69E-02	pCi/g
07-07017-04	00	5601-FSS-SU3-1014	05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Uranium-235	EML U-02 Modified	1.10E-01	7.95E-02	4.06E-02	3.73E-02	pCi/g
		-											1
07-07017-01	SOT	KNOWN	00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Uranium-238	EML U-02 Modified	8.02E+00	2.89E-01			pCi/g
07-07017-01	SOT	SPIKE	00:00 20/50/20	7/5/2007	7/12/2007	07-07017	Uranium-238	EML U-02 Modified	7.78E+00	1.31E+00	6.70E-01	6.28E-02	pCi/g
07-07017-02	MBĽ	BLANK	00:00 20/02/01	7/5/2007	7/12/2007	07-07017	Uranium-238	EML U-02 Modified	9.40E-02	6.94E-02	3.54E-02	5.56E-02	pCi/g
07-07017-03	DUP	5601-FSS-SU3-1014	05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Uranium-238	EML U-02 Modified	5.97E-01	1.79E-01	9.14E-02	2.79E-02	pCi/g
07-07017-04	20	5601-FSS-SU3-1014	05/25/07 09:45	7/5/2007	7/12/2007	07-07017	Uranium-238	EML U-02 Modified	7.70E-01	2.17E-01	1.11E-01	7.27E-02	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original



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#### **SECTION V**

QUALITY CONTROL SAMPLE RESULTS SUMMARY

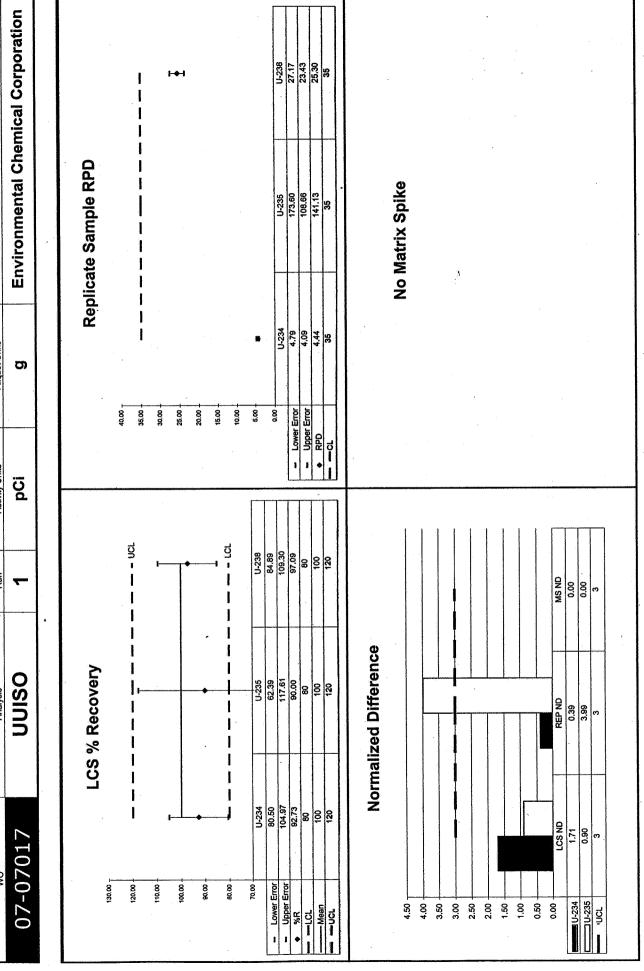
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> Eberline Services Analysis Control Chart

											On the little		
WO		Analysis		Run	Activity Units	, Units	Aliquot Units	CUIES			Cileir Italie		
07-07017		OSION		_	ď	pCi	Đ		Enviro	nmental	Chemic	Environmental Chemical Corporation	ration
							•						
				Labo	ratory C	Laboratory Control Sample	Sample	:					
Analyte	Normalized Difference	LCS Measured	CSU	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
U-234	1.71	92.73%	8.64%	100.00%	3.60%	8.22E+00	2.96E-01	7.63E+00	6.58E-01	U-8a	3.52E+01	3.60E+00	5,18E-01
U-235	0:00	%00.06	24.01%	100.00%	3.60%	3.73E-01	1.34E-02	3.36E-01	8.07E-02	U-8a	1.60E+00	3.60E+00	5.18E-01
U-238	99.0	97.09%	8.61%	100.00%	3.60%	8.02E+00	2.89E-01	7.78E+00	6.70E-01	U-8a	3.44E+01	3.60E+00	5.18E-01
					Matri	Matrix Spike		-				:	
Analyte	Normalized Difference	MS Actual % Rec	Expected MS Result	Expected MS Uncert	Actual MS Result	Actual MS CSU	Sample Result	Sample CSU	Sample Aliquot	Standard ID	Standard ACT (dpm)	Standard Error %	Standard Added (g)
	Rep	Replicate Sample	ample						OC	QC Summary	ary		
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU	LCS Relative Bias	LCS % R	TCS ND	MS % R	MS ND	Rep RPD	Rep ND
U-234	0.39	4.44	5.82E-01	9.36E-02	6.08E-01	9.27E-02	0.93	OK X	OK			OK	OK
U-235	3.99	141.13	1.10E-01	4.06E-02	1.90E-02	1.88E-02	0.90	Ą	OK			IN	N/S
U-238	2.36	25.30	7.70E-01	1.11E-01	5.97E-01	9.14E-02	0.97	9K	ОК			INV	OK

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**Environmental Chemical Corporation** Aliquot Units Ø pCi Run UNISO Eberline Services Analysis Control Chart 07-07017



Eberline Services Analysis Control Chart					Printed: 7/13/2007 11:48 AM Page 1 of 2
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
07-07017	Thiso	~	Ö	ס	Environmental Chemical Corporation

					Labo	Laboratory Control Sample	ontrol	Sample						
Analyte		Normalized Difference	LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
TH-228		0.70	104.43%	11.70%	100.00%	3.60%	4.76E+00	1.71E-01	4.97E+00	5.82E-01	Th-8b	1.04E+02	3.60E+00	1.02E-01
TH-230		0.29	101.73%	11.58%	100.00%	2.70%	5.32E+00	1.44E-01	5.41E+00	6.26E-01	Th-1b	2.35E+01	2.70E+00	5.02E-01
TH-232		1.79	112.06%	11.59%	100.00%	3.60%	4.76E+00	1.71E-01	5.34E+00	6.18E-01	Th-8b	1.04E+02	3.60E+00	1.02E-01
						Matri	Matrix Spike					•		,
Analyte	-	Normalized Difference	MS Actual % Rec	Expected MS Result	Expected MS Uncert	Actual MS Result	Actual MS CSU	Sample Result	Sample CSU	Sample Aliquot	Standard ID	Standard ACT (dpm)	Standard Error %	Standard Added (g)
					-									
				-							-			
	, .:	Rep	Replicate Sample	ample				,		ØC	QC Summary	ary		
Analyte	:	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU	LCS Relative Blas	LCS % R	LCS ND	MS % R	MS ND	Rep RPD	Rep ND
TH-228		1.04	13.78	8.69E-01	1.53E-01	7.57E-01	1.46E-01	1.04	ОК	OK		- 1	OK	ОĶ
TH-230		0.62	7.96	7.90E-01	1,40E-01	8.56E-01	1.54E-01	1.02	OK	ОК			9 X	Š
TH-232		2.47	33.23	8.43E-01	1.46E-01	6.03E-01	1.22E-01	1.12	Ą	OK	-		INV	OK

**Environmental Chemical Corporation** Printed: 7/13/2007 11:48 AM Page 2 of 2 0 pCi Thiso Eberline Services Analysis Control Chart

Martix Spike   Mart								
The color of the								
100   100		Ö	S % Recovery			Replica	te Sample RPD	
100   100	130.00		. ~ *	ŀ	•			
1400   1500	120.00			TON	80.04			<b>*</b> ]
100   100	110.00			·· •	866	     		
100   100	100.00	•			25.00			-
1.00   1.00	00:08			ł	20.00			
Thicke   T	00.08	1		- ICI	15.00	<b>i÷i</b>		
1					10.00		iei	÷.
100 cm   1	70.00	TH-228	TH-230	TH-232	2009			,
150   150	- 1	89.14	87.46	96.87	00.00	000 114	COC 111	CCC 174
1,00	- 1	119.73	116.01	127.24		1H-228	1H-230	1H-232
Normalized Difference    130	<b>♦</b> %R	104.43	101.73	312.06	- 1	15.05	8,6/	36.31
Normalized Difference    Normalized Difference	707 <b>1</b>	00	06	00		12.51	67.7	\$1.00
Normalized Difference  Normalized Difference  No Matrix Spike	Mean	100	001	200	◆ RPD	13.78	7.95	33.23
Normalized Difference  LCSND  LCSND  O770  0.70  0.29  0.62  0.62  0.62  0.62	] [ ]	02.1	120	0.21	ਹ <b>ੇ</b>	35	35	Đ.
Normalized Difference  LCS ND LCS ND 0.70 0.70 0.29 0.29 0.62 0.00 0.20 0.29 0.62 0.00 0.00								***************************************
LCS ND REP ND MS ND 0.70 1.04 0.00 0.29 0.62 0.00 3 3 3 3		Norme	lized Difference					
LCS ND REP ND MS ND  0.70 1.04 0.00  0.29 0.62 0.00  3 3 3	C C				<del>i sa i sa iyi</del>	<u>8</u>	Matrix Spike	
LCS ND REP ND MS ND  0.70 1.04 0.00  0.29 0.62 0.00  3 3 3	3							
LCS ND REP ND MS ND  0.70 1.04 0.00  0.29 0.62 0.00	3.00							
LCS ND REP ND MS ND 0.70 1.04 0.00 0.29 0.62 0.00 3 3 3	2.50							-
LCS ND REP ND 0.70 1.04 0.29 0.62	00 6				·	ं •	1	
LCS ND REP ND 0.70 1.04 0.62 0.62 3			*					
LCS ND REP ND 1.04 0.62 3 3	1.50							
LCS ND REP ND 0.70 1.04 0.62 0.62 3 3	1.00				- <del></del>			
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LCS ND REP ND 0.70 1.04 0.29 0.62 3 3								
0.70 1.04 0.29 0.62 3 3	900	CS ND	REP ND	MS ND				
0.29 0.62 3 3	TH-228	0.70	1.04	0.00				
r	TH-230	0.29	0.62	0.00				
	,UCL	က	က	က	-			
					~			

OM		Analysis		Run	Activity Units	Units	Aliquot Units	Units			Client Name		
07-07017		Ra226	*	~	DG	77	Ō		Enviro	nmenta	Chemic	Environmental Chemical Corporation	ration
				Labo	aboratory Control Sample	control	Sample						
Analyte	Normalized Difference	LCS Measured	CSU Measured	LCS	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
RA-226	1.07	104.15%	6.73%	100.00%	4.60%	1.01E+01	4.66E-01	1.06E+01	7.10E-01	Ra-5b	4.42E+01	4.60E+00	5.09E-01
								- v					
	,												
					Matri	Matrix Spike		-					
Analyte	Normalized Difference	MS Actual % Rec	Expected MS Result	Expected MS Uncert	Actual MS Result	Actual MS CSU	Sample Result	Sample CSU	Sample Aliquot	Standard ID	Standard ACT (dpm)	Standard Error %	Standard Added (g)
				:									
	-												
	Rep	Replicate Sample	ample		,				OC	QC Summary	ary		
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU	LCS Relative Blas	CCS % R	TCS ND	MS%R	MS ND	Rep RPD	Rep ND
RA-226	2.12	27.29	1.01E+00	1.69E-01	7.71E-01	1.49E-01	1.04	OK	Ą			INV	OK

Eberline Services Analysis Control Chart

Printed: 7/11/2007 10:56 AM Page 2 of 2

**Environmental Chemical Corporation** Replicate Sample RPD No Matrix Spike RA-226 29.72 24.86 27.29 35 O) - Lower Error
- Upper Error
♦ RPD 35.00 30.00 25.00 20.00 15.00 10.00 8,0 8 40.00 Activity Units Ö 0.00 3 뙲 Normalized Difference LCS % Recovery Ra226 RA-226 92.81 115.48 104.15 80 100 REP ND 2.12 3 LCS ND 1.07 07-07017 130.00 120.00 110.00 100.00 70.00 90.00 80.00 RA-226 2.00 -0.50 3.50 3.00 2.50 9. 0.00 . 50 - Wean

Printed: 7/13/2007 2:26 PM Page 1 of 2

Eberline Services Analysis Control Chart

OM		Analysis		Run	Activit	Activity Units	Allono	Alignot Units			Client Name		
07-07017		Ra228		_	a	pCi	J,	D	Enviro	nmenta	Environmental Chemical Corporation	al Corpo	ration
			*										
				Labo	ratory (	Laboratory Control Sample	Sample					-	
Analyte	Normalized Difference	LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	nso	Standard ID	Standard ACT (dpm)	Standard	Standard Added (g)
RA-228	5.88	87.14%	3.58%	100.00%	4.50%	3.79E+01	1.71E+00	3.30E+01	1.18E+00	Ra-10	1.03E+02	4.50E+00	8.16E-01
			•					-				-	-
					Matri	Matrix Spike			•			-	
Analyte	Normalized Difference	MS Actual % Rec	Expected MS Result	Expected MS Uncert	Actual MS Result	Actual MS CSU	Sample Result	Sample CSU	Sample Aliquot	Standard ID	Standard ACT (dpm)	Standard Error %	Standard Added (g)
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e de la companya de													
	000	liooto C	Jumo										
	day	replicate Sample	ample						3	ac summary	ary		
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU	LCS Relative Bias	LCS % R	TCS ND	MS%R	MS ND	Rep RPD	Rep ND
RA-228	2.30	64.29	6.29E-01	1.69E-01	3.23E-01	1.99E-01	0.87	ОК	INV			ANI	OK
						-							
										-	-		

Eberline Services Analysis Control Chart					Printed: 7/13/2007 2:26 PM Page 2 of 2
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
07-07017	Ra228	_	pCi	ס	Environmental Chemical Corporation
				٨	
	/ Box 90			Ö	licate Samula BBD
130.00 1	co % Recovery			2	Neplicate Sample NFD
120.00			4	40.00	
110.00			8	36.00	
100.001			· .	30.00	
00'08				20.00	
00'08	<b>•</b>		<del>*</del>	15.00	
}	•		¥	10.00 -	
70.00	RA-228			5.00	
	79.06			00:00	
■ Upper Error	95.22				RA-228
manne manne [C]	80		L Upper E	ior	51.88
Mean	100		◆ RPD		64.29
700	2		7		95
Norn	Normalized Difference				
7.00					No Matrix Spike
6.00					
5,00					*
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3.00			<u>.</u>		
2,00					
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0.00 LCS ND	REP ND	MS ND		•	
5.88 5.88	2.30	0.00	1 1		
		?	· ]		
	•				

## SECTION VI

LABORATORY TECHNICIAN'S NOTES.

ISO-U NOTES



**Work Order Analysis Notes** 

Oak Ridge Laboratory

601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	UUISO
Run Number	1

# Date Dept	User	Notes
1 07/06/07 09:14 PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS

B-16/07



**Work Order Analysis Notes** 

#### **Oak Ridge Laboratory**

601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	UUISO
Run Number	1

#	Date	Dept	Üser	Notes
1	07/06/07 09:14	PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS
2	07/11/07 10:20	CHEM	TSMITH	Followed steps 12.2 to 12.2.7 in AP-005 rev. 9 . ( Column separation for Uranium )
3	07/12/07 05:45	CHEM	TSMITH	Followed steps 12.2.7 to 12.5.5 in AP-005 rev. 9 . ( Precipitated and filtered samples )

SUNT 7POT

Printed: 7/12/2007 5:57 AM Page 1 of 1

Ouk Mage Labo		1 0g0 2 01 2				
Ø E B	ERLINE SERVICES		nal Work Order -07017 Code	Rün		
- <del></del>	ents Used in an Analysis	UUI	50	1		
Reagent ID	Reagenti Name	Reagent Concentration	Analyst ID	Date Recorded		
005772P	Hydrofluoric Acid	Reagent Grade	JBARNARD	7/6/2007		
005486P	Perchloric Acid	Reagent Grade	JBARNARD	7/6/2007		
004527P	Sulfuric Acid	Reagent Grade	JBARNARD	7/6/2007		
005886P	Nitric Acid	Reagent Grade	JBARNARD	7/6/2007		
005839D03 Hydrochloric Acid		0.5N	TSMITH	7/11/2007		
005592S Hydrochloric Acid		6.5N	TSMITH	7/11/2007		
005947S	Hydrochloric Acid	8N	TSMITH	7/11/2007		
005955S	HCI - NH4I	8N - 0.1M	TSMITH	7/11/2007		
005927S	HCI - HF	6.5N - 0.04N	TSMITH	7/11/2007		
005554S	Neodymium Carrier	1 mg/ml	TSMITH	7/12/2007		
005345P	Titanous Chloride	Reagent Grade	TSMITH	7/12/2007		
005913P	Reagent Alcohol .	Reagent Grade	TSMITH	7/12/2007		
005878P	Hydrofluoric Acid	Reagent Grade	TSMITH	7/12/2007		
005909S	Carbon substrate	Solution	TSMITH	7/12/2007		

			Alpha	#3		· <u>·</u>	45
	DATE		Client IO.		Court Tone	Analysis	Ted
	7-3-07	6706152A(1-4)	Parsons	16:15	5#a 35-	Pu	<i>S</i> 2
(0.10	7.3-07	0706151A (1-4)	ALMAC	16:17	24250_	Po 210	52
	7.503	Daily pulsey	LAB	0816	10m	M	
	7-5-07	0706147A(1-4)	BJC	17:15	24m50_	Am	\$2
	7-5-07	67061484(1-5)	BJC	1720	2HL50_	An	\$22
	7.4.7	Daily pulser 0706136A (1-2.5)	LAB	0620	10m	M	
	76.07	0706136A (1-2,5)	372	0744	ZHVR SOM	Am	
	7.6.08	07061324 (1-5)	S.T.	0744	ettre 50m	Ph	ju.
	7/6/07	Weekly Calibrations	LAB	12:30	21/24er	ح	AC
	7/6/07		LAB	15:27	16 HR40W		AG
• • • • • • • • • • • • • • • • • • • •	790	Daily pulse	UBYB	orso	10-	ps.	1
	740	1706/254 (7)	Styler/NW	0757	5KZ 352	R	1
	791	12061524 (1-4)	Persons	0757	STRE 35 L	Am	
·	7-9-07	07061454(1-8)	BJC	20:30	5m35_	uu	- <b>X</b>
	710.07	Darly pulser	LANS	0541	10n	N	
	710-07	0706145A(1-8)	BJC	19:50	5 un 35 m	Pa	
	7.11.4	Daily pulse	LAM	674	10n	NA	1
	74.07	U706/32A (1-6)	S.T.	0847	242502	The	1
	7-11-07	0707025A (1-3)	Pcc	0942	24n 50m	the	10
	7-11-07		N.D.	17:45	24n50_	Ra	
	7-12-4	Daily pulser	LAB	0723	10m	No	
· ·	7720	0707001A(4)	MiGC	0428	24 50m	lu	4,
<del></del>	7.12.03	0707017A (1-4)	GCC	0928	Um jon	ha	
	712.07	0707024A (1-3)	usc	0928	zure Jon	lu	
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**ISO-TH NOTES** 



**Work Order Analysis Notes** 

Oak Ridge Laboratory

601 Scarboro Rd.
Oak Ridge, TN 37830
Voice: 865.481.0683
www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	ThISO
Run Number	1

# ]	Date	Dept	User .	Notes
1	07/06/07 09:13	PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- PRECIPITATED WITH POTASSIUM SULFATE AND BA CARRIER- DECANTED SAMPLES AND CENTRIFUGED- ADDED .25M EDTA TO PRECIP, VORTEXED AND PUT SAMPLES IN A HOT WATER BATH- ADDED 10M KOH AND TICL3 AND PUT SAMPLES BACK IN THE HOT WATER BATH- VORTEXED AND CENTRIFUGED- ADDED 30MLS OF 8N HNO3 TO THE THORIUM PRECIP, VORTEXED AND SUBMITTED TO SEPARATIONS

7/4/07



**Work Order Analysis Notes** 

Oak Ridge Laboratory

601 Scarboro Rd.
Oak Ridge, TN 37830
Voice: 865.481.0683
www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	ThISO
Run Number	1

# 1	Date	Dept	User	Notes
1	07/06/07 09:13	PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- PRECIPITATED WITH POTASSIUM SULFATE AND BA CARRIER- DECANTED SAMPLES AND CENTRIFUGED- ADDED .25M EDTA TO PRECIP, VORTEXED AND PUT SAMPLES IN A HOT WATER BATH- ADDED 10M KOH AND TICL3 AND PUT SAMPLES BACK IN THE HOT WATER BATH- VORTEXED AND CENTRIFUGED- ADDED 30MLS OF 8N HNO3 TO THE THORIUM PRECIP, VORTEXED AND SUBMITTED TO SEPARATIONS
2	07/11/07 10:21	CHEM	TSMITH	Followed steps 12.3 to 12.3.4 in AP-005 rev. 9 . ( Column separation for Thorium )
3	07/12/07 05:50	CHEM	TSMITH	Followed steps 12.3.4 to 12.5.5 in AP-005 rev. 9 . ( Precipitated and filtered samples )

7-12-07

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	ERLINE SERVICES ents Used in an Analysis			Run 1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
003255D25	Barium Carrier	50 mg/ml	JBARNARD	7/6/2007
005827S	EDTA	0.25M	JBARNARD .	7/6/2007
005772P	Hydrofluoric Acid	Reagent Grade	JBARNARD	7/6/2007
005886D01	Nitric Acid	- 8N	JBARNARD	7/6/2007
005886P	Nitric Acid	Reagent Grade	JBARNARD	7/6/2007
005486P	Perchloric Acid	Reagent Grade	JBARNARD	7/6/2007
001365D04	Potassium Hydroxide	10M	JBARNARD	7/6/2007
005804P	Potassium Sulfate	Reagent Grade	JBARNARD	7/6/2007
004527P	Sulfuric Acid	Reagent Grade	JBARNARD	7/6/2007
004692P	Titanous Chloride	Reagent Grade	JBARNARD	7/6/2007
005951S	Nitric Acid	8N	TSMITH	7/11/2007
005947S	Hydrochloric Acid	8N	TSMITH	7/11/2007
005909S	Carbon substrate	Solution	TSMITH	7/12/2007
000051D11	Cerium Carrier (Alpha iso)	Solution	TSMITH	7/12/2007
005913P	Reagent Alcohol	Reagent Grade	TSMITH	7/12/2007
005878P	Hydrofluoric Acid	Reagent Grade	TSMITH	7/12/2007

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	<b>*</b>		Alpha	1		vo	42
	Dore	Somple #	Chent	Loud fine	OT time	1.1:-	43
_ & P = (	710-08	Dark pulsar	MB	6541	10m	Analysis	龙
40-16-	7.10.4	0706124 A (1,2,45,7)	Stollerlan	0718	SHR 35 mi	lu	1 No.
16 11 11	710.03	U7U6125A ( 1-6)	Stoller MAN	<i>ज</i> शष्ट	Stre 35m	un	m
$\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j$	7-10-07	0707017 RA(1-4)	ECC	15:30	24250_	Rc	12
	7-10-07	07 07010A (1-5)	BJC	20:30	2HL50_	un	100
	2-10-07	07061324(1-5)	Solutient	20!35	2m50_	uu	92
	71108	Darly pulser	Las	0711	10_	NA	R
1,55	7-11-0	brouge (1-4)	MIEC	1590	EMESON	lu	1
- 3 3 5	7-11-7	U7061464 (1-7)	Brc	0921	24a5Ow	Pa	m
** ** <b>*</b> **	711:4	V707010A (1)	350	0921	ZHESUM	Pa	
	7-11-07	07 0 7025 A(4-7)	PCC	12:30	2415a	77	100
44 12 3	7-12-4	Daily pulses	LAB	6553	10m	NA	the second
78. 44.	7.12.19	0707010A (1-5)	BJZ	0928	Zne SOn	No	1
<u> </u>	712.05	070701SA (1-4)	Pasons	0428	ZHE SOM	W	La la
V1. 2. 1	7-12-19	0707001A (1-3)	MIEC	0928	240250m	lu	12
	7-12-07	0707024A/4)	USG	12:43	2m50_	UU	2
	712-07	0707001A/1-4)	MEC	12:44	2HR50_	な	5
	7-1207	07070174(1-4)	Ecc	12:45	2m50_	龙	2
	7-12-01	67070244(1-3)	usG	12:46	211-50-	Th	5
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**RA-226 NOTES** 



**Work Order Analysis Notes** 

**Oak Ridge Laboratory** 

601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	Ra226
Run Number	1

#	Date	Dept	User	Notes
1	07/06/07 09:12	PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- PH'D SAMPLES TO 2.8-3.0- PRECIPITATED WITH POTASSIUM SULFATE AND BA AND PB CARRIERS- DECANTED SAMPLES AND CENTRIFUGED- ADDED .25M EDTA AND PHENOLPTHALEIN TO PRECIP, VORTEXED AND PUT SAMPLES IN A HOT WATER BATH- VORTEXED AND CHECKED PH- CENTRIFUGED AND TRANSFERRED SUPERNATE INTO CLEAN C-TUBES AND SUBMITTED TO SEPARATIONS



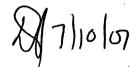
**Work Order Analysis Notes** 

Oak Ridge Laboratory 601 Scarboro Rd.

Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	Ra226
Run Number	1

#	Date	Dept	User	Notes
1	07/06/07 09:12	PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- PH'D SAMPLES TO 2.8-3.0- PRECIPITATED WITH POTASSIUM SULFATE AND BA AND PB CARRIERS- DECANTED SAMPLES AND CENTRIFUGED- ADDED .25M EDTA AND PHENOLPTHALEIN TO PRECIP, VORTEXED AND PUT SAMPLES IN A HOT WATER BATH- VORTEXED AND CHECKED PH- CENTRIFUGED AND TRANSFERRED SUPERNATE INTO CLEAN C-TUBES AND SUBMITTED TO SEPARATIONS
2	07/10/07 13:09	CHEM	DJOHNSON	Received samples in EDTA from prep lab. Re-precipitated samples with glacial acetic acid and ammonium sulfate. Recorded T0 time of 1230 hours. Filtered samples on tarred filters and then rinsed c-tubes and funnels with diH2O and filtered. Dried and reweighed samples. Submitted samples to the count room.



005186D04

0047695

Ammonium Sulfate

**EDTA** 

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**DJOHNSON** 

**DJOHNSON** 

7/10/2007

7/10/2007

				rage I of I
Ø E E	SERLINE SERVICES	07		Run
Reag	ents Used in an Analysis	Ra2	26	1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
005432P	Ammonium Hydroxide	Reagent Grade	JBARNARD	7/6/2007
003255D26	Barium Carrier	1 mg/ml	JBARNARD	7/6/2007
005827S	EDTA	0.25M	JBARNARD	7/6/2007
005772P	Hydrofluoric Acid	Reagent Grade	JBARNARD	7/6/2007
004484D03	Lead Carrier	40 mg/ml	JBARNARD	7/6/2007
005886P	Nitric Acid	Reagent Grade	JBARNARD	7/6/2007
005486P	Perchloric Acid	Reagent Grade	JBARNARD	7/6/2007
003643S	Phenolphthalein Indicator	0.1%	JBARNARD	7/6/2007
005804P	Potassium Sulfate	Reagent Grade	JBARNARD	7/6/2007
004527P	Sulfuric Acid	Reagent Grade	JBARNARD	7/6/2007
000868P	Acetic Acid	Reagent Grade	DJOHNSON	7/10/2007
	5			

200 mg/ml

0.25M

Somple #
Daily pulon
0706124 A (1,2,45,7)
0706125A (1-6)
0707017 RA (1-4) Loudine Of time 6541 Stollarlaw SHR 35 mi 0718 7.10·A Stoller /MV ECC SHR 35m 2HR50-0718 7-10-07 15:30

**RA-228 NOTES** 



**Work Order Analysis Notes** 

# **Oak Ridge Laboratory**

601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	Ra228
Run Number	1.

	Date	Dept	User	Notes
1	07/06/07 09:12	PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL  NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- PH'D SAMPLES TO 2.8-3.0-  PRECIPITATED WITH POTASSIUM SULFATE AND BA AND PB CARRIERS- DECANTED SAMPLES AND  CENTRIFUGED- ADDED .25M EDTA AND PHENOLPTHALEIN TO PRECIP, VORTEXED AND PUT  SAMPLES IN A HOT WATER BATH- VORTEXED AND CHECKED PH- CENTRIFUGED AND  TRANSFERRED SUPERNATE INTO CLEAN C-TUBES AND SUBMITTED TO SEPARATIONS

Bent 7/4/07



**Work Order Analysis Notes** 

Oak Ridge Laboratory 601 Scarboro Rd.

Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com

Internal Work Order	07-07017
Analysis Code	Ra228
Run Number	1

#	Date	Dept	Üser	Notes
1	07/06/07 09:12	PREP	JBARNARD	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HF AND DRIED SAMPLES DOWN UNTIL NEAR DRY- ADDED MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- PH'D SAMPLES TO 2.8-3.0- PRECIPITATED WITH POTASSIUM SULFATE AND BA AND PB CARRIERS- DECANTED SAMPLES AND CENTRIFUGED- ADDED .25M EDTA AND PHENOLPTHALEIN TO PRECIP, VORTEXED AND PUT SAMPLES IN A HOT WATER BATH- VORTEXED AND CHECKED PH- CENTRIFUGED AND TRANSFERRED SUPERNATE INTO CLEAN C-TUBES AND SUBMITTED TO SEPARATIONS
2	07/11/07 06:30	CHEM	DJOHNSON	Filters were returned from the count room and were placed into centrifuge tubes with EDTA.
3	07/12/07 13:22	СНЕМ	DJOHNSON	Removed filters from soaking and discarded them. Adjusted PH and added Yttrium carrier. Removed Lead interferences through two Lead Sulfide precipitations.
4	07/13/07 09:35	CHEM	DJOHNSON	Added 10mls of 18M NaOH to samples and recorded T1 time of 0650 hours for samples. Hot bathed and centrifuged samples. The supernates were discarded Dissolved samples in 2mls of 6N HNO3. Then added 5mls of DiH2O and 3mls of 10M NaOH.
5	07/13/07 09:35	CHEM	DJOHNSON	Then vortexed, hot bathed and centrifuged samples. The supernates were discarded. Then added 2mls of 1N HNO3 and 2mls of 5% Ammonium Oxalate. Samples were vortexed, hot bathed and centrifuged. The supernates were then discarded. The precipitates were
6	07/13/07 09:35	CHEM	DJOHNSON	slurried with 5mls of DiH2O and vortexing. The samples were filtered on tarred filters. The c-tubes and funnels were rinsed with DiH2O and filtered. The filters were dried and reweighed. Sample#5 was low in recovery at ~59%. Mounted samples on planchets.
7	07/13/07 09:35	CHEM	DJOHNSON	Samples were covered in aluminum foil and submitted to the count room.

7/13/01

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<b>&amp;</b>	<u> </u>		1 Work Order	
EE	SERLINE SERVICES	Analysis Co		Run
Reag	ents Used in an Analysis	Ra22	8	1.1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
005432P	Ammonium Hydroxide	Reagent Grade	JBARNARD	7/6/2007
003255D26	Barium Carrier	1 mg/ml	JBARNARD	7/6/2007
005827S	EDTA	0.25M	JBARNARD	7/6/2007
005772P	Hydrofluoric Acid	Reagent Grade	JBARNARD	7/6/2007
004484D03	Lead Carrier	40 mg/ml	JBARNARD	7/6/2007
005886P	Nitric Acid	Reagent Grade	JBARNARD	7/6/2007
005486P	Perchloric Acid	Reagent Grade	JBARNARD	7/6/2007
003643S	Phenolphthalein Indicator	0.1%	JBARNARD	7/6/2007
005804P	Potassium Sulfate	Reagent Grade	JBARNARD	7/6/2007
004527P	Sulfuric Acid	Reagent Grade	JBARNARD	7/6/2007
005835S	EDTA	0.25M	DJOHNSON	7/12/200
001848D14	Lead Carrier	1.5 mg/ml	DJOHNSON	7/12/200
005765P	Nitric Acid	Reagent Grade	DJOHNSON	7/12/200
005963D01	Ammonium Sulfide	2%	DJOHNSON	7/12/200
000037D02	Ammonium Oxalate	5%	DJOHNSON	7/13/200
005026D03	Nitric Acid	1N ·	DJOHNSON	7/13/200
005700D01	Nitric Acid	6N	DJOHNSON	7/13/200
005802D02	Sodium Hydroxide	10M	DJOHNSON	7/13/200
000994S	Yttrium Carrier	9 mg/ml	DJOHNSON	7/13/200
005802D03	Sodium Hydroxide	. 18M	DJOHNSON	7/13/200

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# SECTION VII ANALYTICAL DATA (ISOTOPIC URANIUM)

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07-07017 UNISO

Eberline Services Oak Ridge Laboratory Analysis Sheet

Run 1

1.0000E+00 1.0000E+00 1.2611E+00 1.2002E+00 Sample Aliquot 05/25/07 09:45 07/05/07 00:00 05/25/07 09:45 07/05/07 00:00 Sample Date V- 1 Login 49 49 5601-FSS-SU3-1014 5601-FSS-SU3-1014 **BLANK** Cllent CS Sample Desc DUP CS MBL 8 Internal Fraction 9 2 02 6 **Environmental Chemical Corporation** Alpha Spectroscopy **EML U-02 Modified** 07-07017 7/26/2007 7/5/2007 Li Tungsten UNISO **U-10a U-232** 20.386 ၓၙ 80 4 D Client Project Carrier Run **Activity Units** Matrix Instrument Type Analysis Code Aliquot Units Method Radiometric Sol# Tracer Act (dpm/g) **Work Order Date Received** Lab Deadline Report Level Radiometric Tracer Carrier Conc (mg/ml)

\* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. \*\* Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

Printed: //12/2007 5:57 AM Page 2 of 3

07-07017 UUISO Run 1

Eberline Services Oak Ridge Laboratory Analysis Sheet SAF 2\* SAF Mean % Rec Grav % Rec Grav Filter Net (g) Grav Filter Final (g) Grav Filter Tare (g) Grav Carrier Added (ml) Radiometric 6 Radiometric Tracer (pCl) 12.6 12.5 12.5 12.5 Tracer Total ACT (dpm) 0.6148 0.6156 0.6123 0.6171 Tracer Allquot (g) Sample Desc DQP PP CS MBL 8 Internal Fraction 02 3 9 5

\* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. \*\* Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

Printed: 7/12/2007 5:57 AM Page 3 of 3

07-07017 UUISO Run 1

Eberline Services Oak Ridge Laboratory Analysis Sheet

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\* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. \*\* Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

Printed: 7/12/2007 1:37 PM Page 1 of 3

# Preliminary Data Report & Analytical Calculations Work Order: 07-07017-UUISO-1

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Preliminary Data Report & Analytical Calculations Work Order: 07-07017-UUISO-1

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Preliminary Data Report & Analytical Calculations Work Order: 07-07017-UUISO-1

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Preliminary Data Report & Analytical Calculations Work Order: 07-07017-UUISO-1

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07-07017-UUISO-1 (pCi/g) in SO Tracer ID: U-10a

Count Room Report
Client: Environmental Chemical Co

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	MBL	BLANK	07/05/07 00:00	1.0000	0.6156	12.5496				
	DUP	5601-FSS-SU3-1014	05/25/07 09:45	1.2611	0.6148	12.5333				
-	8	5601-FSS-SU3-1014	05/25/07 09:45	1.2002	0.6123	12.4823				
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Spike and Tracer Worksheet

Eberline Services Oak Ridge Laboratory

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/sotope	# /oS	Activity dpm/g	Solution Date	Approx Addition	Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Known	Error Estimate	Added pCi	Error Estimate	Known	Error Estimate	Added	Error Estimate
U-234	U-8a	35.240	7/6/2007	0.500	0.5180				8.22	0.296	0.00	0.000	00.0	0.000	0.00	0.000
U-235	U-8a	1.600	7/6/2007	0.500	0.5180			in the second	0.37	0.013	0.00	0.000	0.00	0.000	0.00	0.000
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fraction	Isotope	Sol#	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition		:	Tracer					SOT		
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03	U-232	U-10a	20.386	7/6/2007	0.6148	0.5900		i								
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Eberline Services - Oak Ridge Version 2.0 8/1999

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In Type Ratio  ID Type Ratio  ID Type PostPre  S LCS  WK MBL  103-1014 DUP  103-1014 DUP  103-1014 DOP  103-1014 D		Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	dline			Tec	Technician		•
Environmental Chemical Corporation   Sample   Mulfile Data   Mulfile Data   Mishington Data   Mishin		07-07017	~	OSINN	grams	7/26/2	200			JBA	RNARD		
Functionmental Chamical Corporation   Sample   Multiple Data													
Clear   D   Type   Retiro   Roth Discrete   Ratio   Alliquot   Note Equiv.   (mi)	L	Environmental Chemical Corporation	Sample	L		Dilution Data		Aligu	ot Data	MS Aliq	quot Data	H-3 Solic	is Only
LCS	Fraction		Туре		No of Dils	Dil Factor	Ratio	Allquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Allq
SEQUI-FSS-SU3-1014   DUP	5	CS	SOT					1.0000E+00		4			
5601-FSS-SU3-1014         DUP         26/1E+00         26/1E+00           5601-FSS-SU3-1014         DO         1.2002E+00         1.2002E+00           601-FSS-SU3-1014         DO         1.2002E+00         1.2002E+00           601-FSS-SU3-1014         DO         1.2002E+00         1.2002E+00           701-FSS-SU3-1014         1.2002E+00         1.2002E+00         1.2002E+00           801-FSS-SU3-1014         1.2002E+00         1.2002E+00         1.2002E+00           801-FSS-SU3-1014         1.2002E+00         1.2002E+00         1.2002E+00	02	BLANK	MBL		1			1.0000E+00					
5601-FSS-SU3-1014   DO	83	5601-FSS-SU3-1014	PUP.					1.2611E+00					,
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Eberline Services - Oak Ridge Prep Logbook Version 2.0 8/1999

Rough Sample Preparation Log Book

Printed: 7/6/2007 8:29 AM Page 1 of 1

JPACHELLA Technician 7/7/2007 Date Returned 7/6/2007 Date Sealed Date Received in Prep 7/5/2007 Lab Deadline 7/26/2007 07-07017 Work Order

-	Eberline Environmental Chemical Corporation	Tare (g)	Gross (g)	(B)	Net (g)	(a)	Perc	Percent	Gai	Gamma	
Fraction	Client ID	Pan Wt	Wet Wt.	Dry Wt.	WetWt	Dry Wt.	Liquid		Dry Wt.	LEPS Wt.	_
1	5601-FSS-SU3-1014	28.4000	1894.6500	1555.1600	1866,2500	1526,7600	18,19%	81,81%			_
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Date Analysis: Rough Prep Logbook

Analysis: UUISO Page No., 5721

# Eberline Services Oak Ridge Laboratory

## ALPHA SPECTROMETRY REPORT 12-JUL-2007 12:25:37

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SAMPLE ID: BATCH ID: 0707017A-UU 01 SAMPLE DATE: 12-JUL-2007 00:00 ALIOUOT: 1.000E+00 gram DETECTOR NUMBER: 034 SAMPLE TITLE: SPIKE AVERAGE EFFICIENCY: ACQ DATE: 12-JUL-2007 09:26 19.80% RECOVERY: 98.45% ELAPSED LIVE TIME: 10200. TRACER ID: UU-10A TRACER FWHM (kev): 91.98 LAMBDA VALUE: 617. ROI TYPE: **STANDARD** CONFIDENCE FACTOR: 4.65 TRACER DPM AT SAMPLE DATE: 12.578

TRACER DPM AT SAMPLE DATE: 12.578 \* CONFIDENCE FACTOR: 4.65
SAMPLE MATRIX: SOIL \* LLD CONSTANT: 2.71
ENERGY CAL DATE: 6-JUL-2007 12:30 \* EFF CAL DATE: 6-JUL-2007 12:30

BKG FILENAME: B\_034\_6JUL07 \* BKG ELAPSED TIME: 60000.

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### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
U232	5302.5	416.00	0.00	99.8	5.666E+00	7.296E-01	3.691E-02
U-234	4761.5	559.83	0.17	99.8	7.625E+00	1.289E+00	6.302E-02
U-235	4385.5	20.00	0.00	80.9	3.360E-01	1.581E-01	4.553E-02
U-236	4485.2	6.00	0.00	90.1	9.051E-02	7.508E-02	4.088E-02
U-238	4184.4	573.83	0.17	100.2	7.782E+00	1.311E+00	6.275E-02

\*\*\* Tracer FWHM > 80.0 Kev \*\*\*

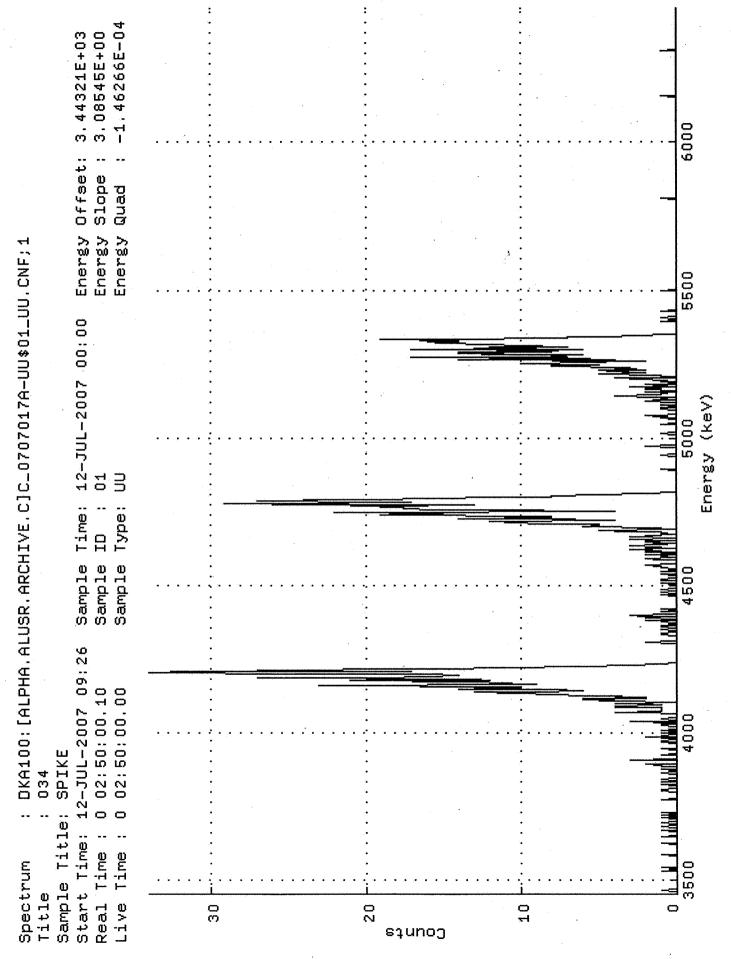
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Reviewer

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Channel	•							*		•				
1: 15: 29: 43: 57: 71: 85: 99: 113: 127: 141: 155: 169: 183: 225: 239: 253: 267: 281: 295: 303: 303: 407: 421: 449: 449: 449: 463: 477: 491: 505: 519: 519: 519: 519: 519: 519: 519: 51	1010000001000148316000201000312780000010031595000000000000000000000000000	0000000010000140140000000114880000001057670001000000000000000000000000	000011100000110132200000103995000200001227700000000000000000000000000	001100000101000493502100111015462010010112219400000000000000000000000000	0000001110100367600020011220862000000140442300000000000000000000000000	0000010101000008930003000100193000000001057700100000000000000000000000	10000000102000044610010010201189000100101127100000000000000000000000000	00000100000124014000000023697000000110372010000000000000000000000000	0000010000204666	00000010001120400000010305270000020223650000000000000000000000000000	000010001016340000100000350100000100481160000000000000000000000000	00000100113003129100100000218480000000020544010000000000000000000000000	00000000000152700111000112113700000210684000000000000000000000000000	0000000000101917001000112301160000000112014900000000000000000000000000

Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:25:33.20

Detector ID: 34 Acquisition Start: 12-JUL-2007 09:26:39.01

Live Time: 0 02:50:00.00 Real Time: 0 02:50:00.10

Batch Id: 0707017A-UU Sample Id: 01

Sample Type: UU

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	4172.04	574	0	56.56	238.92	182	90	5.63E-02	4.2	
2	0	4371.26	20	0	94.72	305.20	281	43	1.96E-03	22.4	
.3	0	4494.75	6	0	0.00	346.50	326	30	5.88E-04	40.8	
4	0	4749.44	560	0	60.96	432.21	382	82	5.49E-02	4.2	×
5	0	5283.43	416	0	91.98	614.31	568	76	4.08E-02	4.9	

Background Counts Within Peak Regions Generated: 12-JUL-2007 12:25:35.31

Acquisition Start: 6-JUL-2007 15:30:35.01

Live Time: 0 16:40:00.00 Real Time: 0 16:40:00.10

Pk It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec %Err	Fit
1 0 2 0 3 0 4 0 5 0	4133.63 4361.54 4476.98 4721.06 5257.08	1 0 0 1 0	0 0 0	3.11 0.00 0.00 3.11 0.00	340.50 422.50	281 326 382	43 30 82	1.67E-05100.0 0.00E+00 0.0 0.00E+00 0.0 1.67E-05100.0 0.00E+00 0.0	•

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:25:35.60

Pk It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1 0	4172.04*	574	0	56.56	238.92	182	90	5.63E-02	4.2	
2 0	4371.26*	20	0	94.72	305.20	281	43	1.96E-03	22.4	
3 0	4494.75*	6	0	0.00	346.50	326	30	5.88E-04	40.8	
4 0	4749.44*	560	0	60.96	432.21	382	82	5.49E-02	4.2	
-5 O	5283 43*	416	Ω	91 98	614 31	568	76	4 08E-02	4 9	

Flag: "\*" = Peak area was modified by background subtraction

### /MS Nuclide Identification Report V3.0 Generated 12-JUL-2007 12:25:36

Configuration : MCA0: [AMSCOUNT] 00021072\$1

: ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3 Analyses by

Sample title : SPIKE

: 12-JUL-2007 00:00:00 Acquisition date : 12-JUL-2007 09:26:39 Sample date

Sample quantity : 1.0000 gram Sample ID : 01

: UU Sample geometry Sample type Detector name

Detector geometry: : 034

Elapsed real time: 0 02:50:00.10 0.0% Elapsed live time: 0 02:50:00.00

Half life ratio : 8.00 Energy tolerance: 100.00 keV Systematic Error: 3.00 % Errors propagated: Yes Efficiency type : Average value Efficiencies at : Peak Energy

Abundance limit 75.00

### Post-NID Peak Search Report

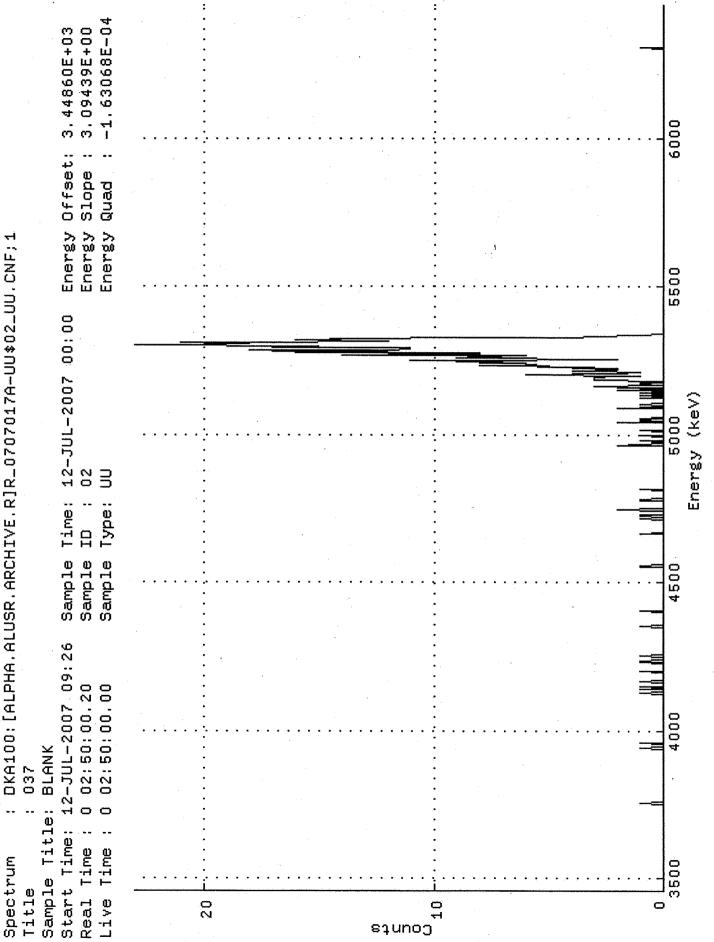
It	Energy	Area	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides	Activity pCi/gram
0	4172.04*	574	56.56	238.92	182	90	8.4		U-238	7.66
Ō	4371.26*	20	94.72	305.20	281	43	44.7		U-235	0.331
Õ	4494.75*	6	0.00	346.50	326	30	81.6		U-236	8.911E-02
.0	4749.44*	560	60.96	432.21	382	82	8.5		U-234	7.51
0	5283.43*	416	91.98	614.31	568	76	9.8		U232	5.58

### ALPHA SPECTROMETRY REPORT 12-JUL-2007 12:25:49

BATCH ID:	0707017A-UU	*	SAMPLE ID:	02
SAMPLE DATE:	12-JUL-2007 00:00	*	ALIQUOT: 1.000E+00	gram
SAMPLE TITLE:	BLANK	*	DETECTOR NUMBER:	037
ACQ DATE:	12-JUL-2007 09:26	*	AVERAGE EFFICIENCY:	19.98%
ELAPSED LIVE TIM	E: 10200.	*	RECOVERY:	110.19%
TRACER ID:	UU-10A	*	TRACER FWHM (kev):	60.74
LAMBDA VALUE:	616.	*	ROI TYPE: S'	TANDARD
TRACER DPM AT SAI	MPLE DATE: 12.548	*	CONFIDENCE FACTOR:	4.65
SAMPLE MATRIX:	SOIL	*	LLD CONSTANT:	2.71
ENERGY CAL DATE:	6-JUL-2007 12:30	*	EFF CAL DATE: 6-JUL-200	7 12:30
BKG FILENAME:	B 037 6JUL07	*	BKG ELAPSED TIME:	60000.

### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
U232	5302.5	468.66	0.34	99.8	5.652E+00	7.037E-01	6.538E-02
U-234	4761.5	8.66	0.34	99.8	1.044E-01	7.410E-02	6.538E-02
U-235	4385.5	2.00	0.00	80.9	2.975E-02	4.229E-02	4.032E-02
U-236	4485.2	-0.17	0.17	90.1	-2.271E-03	4.553E-03	6.181E-02
U-238	4184.4	7.83	0.17	100.2	9.402E-02	6.936E-02	5.556E-02
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337:	0	0	0	0	0	0	0	0 0	0	0 0	0	0	0	0 1
351: 365:	0 1	0	0 0	0	0 0	0	0	0	0	Ö	0	0	Ŏ	ó
379:	Ů	0	0	Ö	Ö	ŏ	Ö	Ŏ	Ö	0	0	0	0	0
393:	0	0	0	0	0	0	.0	0	0	. 1	0	0	0	0
407:	0	0	0	0	0	0 0	0 0	0	0 2	0 0	0	0	1 0	0
421: 435:	0	1 0	1 0	0	0	1	1	Ö	0	0	0	Ŏ	ŏ	ŏ
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463:	0	0	0	0	0	0	.0	0	0	0	0	0	0	0 0
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547:	0 -	0	0	1	0 0	0	0 2	0 0	0 0	1	3	0	1	1
561: 575:	1	1	0	3	3	3	3	2	ĭ	6	2	2	1	3
589:	4	2	2	4	3	8	5	6	6	8	7	11	9	2
603:	9	9	8	6	14	.8	16	8	16 15	18 14	12 8	11 4	11 3	17 1
617: 631:	15 1	23 0	22 0	18 0	21 0	18 0	12 0	16 0	0	0	0	Ō	Ö	Ö
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673: 687:	0	0	0	0	0 0	0 0-	0	0	0 0	0 0	0	0	0	.0 0
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785: 799:	0	Ó	0	0	0	0	0	0	0	0	0	0	0	0
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813: 827:	0	0	0	0	0	Ŏ	.0	ŏ	Ŏ	Ŏ	ŏ	Ŏ	ŏ	Ö
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855:	0	0	0	0	0	0	0 .	0	0	0	0	0	0	0
869:	0	0	0	0	0	0 0	0 0	0	0 . 0	0	0	0	0	0
883: 897:	`0 0	0 0	0	0	0	0	0	0	0	ő	Ö	Ö	.0	0
911:	- 0	.0	.0	0	0	0	0	0	0	0	0	0	0	0
925:	0	0	0	0	0	0	0	0	0	0	0	.0 0	0	0 0
939:	0	0	.0 0	0	0 0	0	0	0	0	0	0	0	0	0
953: 967:	0	0 0	0 0	0	0	1	Ö	0	Ö	ŏ	Ö	ŏ	0	0
981:	Ö	ő	0	0	0	.0	0	0	0	0	0	0	0	0
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1025:	0	U ·												

Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:25:44.18

Detector ID: 37 Acquisition Start: 12-JUL-2007 09:26:50.01

Live Time: 0 02:50:00.00 Real Time: 0 02:50:00.20

Batch Id: 0707017A-UU Sample Id: 02

Sample Type: UU

Pk	It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	4188.27	8	0133.06	242.12	180	90	7.84E-04	35.4	
2	0	4378.71	2	0 55.70	305.50	279	43	1.96E-04	70.7	
3	0	4477.36	0	0 0.00	338.50	324	30	0.00E+00	0.0	
4	0	4744.77	.9	0 3.09	428.56	380	82	8.82E-04	33.3	
5	0	5276.18	469	0 60.74	610.24	567	76	4.60E-02	4.6	

Background Counts Within Peak Regions Generated: 12-JUL-2007 12:25:47.15

Acquisition Start: 6-JUL-2007 15:30:44.01

Live Time: 0 16:40:00.00 Real Time: 0 16:40:00.00

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec %Err	Fit
2 3 4	0 0	4136.75 4363.25 4478.13 4721.40 5260.34	1 0 1 2 2	0 0 0	3.07 73.78	224.50 300.00 338.50 420.50 604.50	279 324 380	43 30 82	1.67E-05100.0 0.00E+00 0.0 1.67E-05100.0 3.33E-05 70.7 3.33E-05 70.7	

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:25:47.44

Pk It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw Cts/Sec %Err Fit
2 0 3 0 4 0	4188.27* 4378.71* 4477.36* 4744.77* 5276.18*	8 2 0 9 469	0 55.70 0 0.00 0 3.09	242.12 305.50 338.50 428.56 610.24	279 324 380	90 7.68E-04 36.2 43 1.96E-04 70.7 30-1.67E-05100.0 82 8.49E-04 34.8 76 4.59E-02 4.6

Flag: "\*" = Peak area was modified by background subtraction

### VMS Nuclide Identification Report V3.0 Generated 12-JUL-2007 12:25:48

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : BLANK

Sample date : 12-JUL-2007 00:00:00 Acquisition date : 12-JUL-2007 09:26:50

Sample ID : 02 Sample quantity : 1.0000 gram

Sample type : UU Sample geometry : Detector name : 037 Detector geometry:

Energy tolerance: 100.00 keV Half life ratio: 8.00 Errors propagated: Yes Systematic Error: 3.00 %

Abundance limit : 75.00

### Post-NID Peak Search Report

It .	Energy	Area FWHM	Channel	Left	Pw %Err	Fit	Nuclides	Activity pCi/gram
0	4188.27*	8133.06	242.12	180	90 72.4	•	U-238	0.104
0	4378.71*	2 55.70	305.50	279	43141.4	•	U-235	3.279E-02
0	4477.36*	0 0.00	338.50	324	30200.0		U-236	-2.502E-03
Ó	4744.77*	9 3.09	428.56	380	82 69.5		U-234	0.115
0	5276.18*	469 60.74	610.24	567	76 9.2		U232	6.23

### ALPHA SPECTROMETRY REPORT 12-JUL-2007 12:25:59

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Spectral File: ND AMS ARCHIVE S:S 0707017A-UUS03 UU.CNF 

B 038 6JUL07

BATCH ID: 0707017A-UU SAMPLE ID: 03 SAMPLE DATE: 25-MAY-2007 00:00 ALIOUOT: 1.261E+00 gram SAMPLE TITLE: 5601-FSS-SU3-1014 DETECTOR NUMBER: 038 ACO DATE: 12-JUL-2007 09:27 AVERAGE EFFICIENCY: 18.70% ELAPSED LIVE TIME: 10200. RECOVERY: 108.89% TRACER ID: UU-10A TRACER FWHM (kev): 92.35 LAMBDA VALUE: 615. ROI TYPE: STANDARD TRACER DPM AT SAMPLE DATE: 12.547 CONFIDENCE FACTOR: 4.65 SAMPLE MATRIX: LLD CONSTANT: 2.71 SOIL ENERGY CAL DATE: 6-JUL-2007 12:30 EFF CAL DATE: 6-JUL-2007 12:30 BKG ELAPSED TIME:

\*

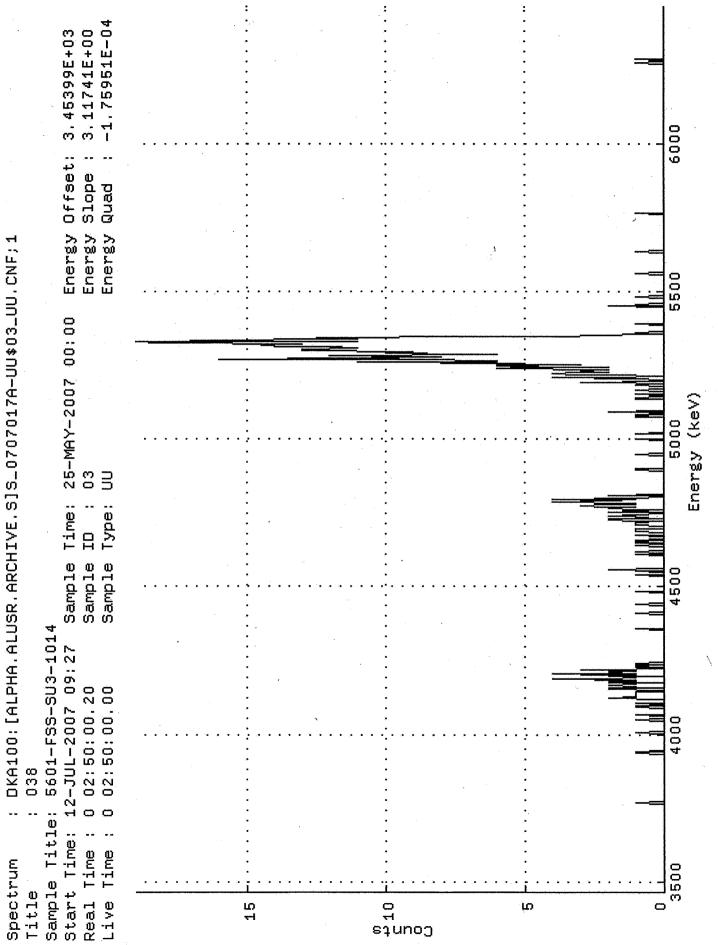
### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
U232	5302.5	433.00	0.00	99.8	4.482E+00	5.708E-01	2.801E-02
U-234	4761.5	58.83	0.17	99.8	6.081E-01	1.817E-01	4.783E-02
U-235	4385.5	1.49	0.51	80.9	1.900E-02	3.694E-02	7.690E-02
U-236	4485.2	2.00	0.00	90.1	2.290E-02	3.256E-02	3.103E-02
U-238	4184.4	58.00	0.00	100.2	5.970E-01	1.791E-01	2.789E-02

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Tracer FWHM > 80.0 Kev

BKG FILENAME:



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659:	0	0	0	0	0	0	2	0	1	0	0	0	0 0	
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1023:	0	0												

Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:25:54.85

Detector ID: 38 Acquisition Start: 12-JUL-2007 09:27:16.01

Live Time: 0 02:50:00.00 Real Time: 0 02:50:00.20

Batch Id: 0707017A-UU Sample Id: 03

Sample Type: UU

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
		4170.59	58	0	36.32	232.93			5.69E-03		•
2	0	4382.42	2	0	59.23	303.00	276	42	1.96E-04	70.7	
.3	0	4460.58	2	0	46.76	329.00	320	30	1.96E-04	70.7	
4	0	4745.05	59	0	29.36	424.31	376	81	5.78E-03	13.0	
5	0	5293.66	433	0	92.35	611.21	562	76	4.25E-02	4.8	

Background Counts Within Peak Regions Generated: 12-JUL-2007 12:25:57.10

Acquisition Start: 6-JUL-2007 15:30:54.01

Live Time: 0 16:40:00.00 Real Time: 0 16:40:00.10

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw Cts/Sec %Err Fit
2	0 0 0	4134.85 4361.84 4476.08 4719.34 5258.31	0 3 0 1	0 0	74.87 0.00 3.12	221.50 296.50 334.50 416.00 599.50	276 320 376	90 0.00E+00 0.0 42 5.00E-05 57.7 30 0.00E+00 0.0 81 1.67E-05100.0 76 0.00E+00 0.0

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:25:57.67

Pk It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2 0 3 0 4 0	4170.59* 4382.42* 4460.58* 4745.05* 5293.66*	58 1 2 59 433	0 0 0	59.23 46.76 29.36	232.93 303.00 329.00 424.31 611.21	276 320 376	42 30 81	5.69E-03 1.46E-04 1.96E-04 5.77E-03 4.25E-02	96.9 70.7 13.1	

Flag: "\*" = Peak area was modified by background subtraction

### /MS Nuclide Identification Report V3.0 Generated 12-JUL-2007 12:25:58

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : 5601-FSS-SU3-1014

Sample date : 25-MAY-2007 00:00:00 Acquisition date : 12-JUL-2007 09:27:16

Sample ID : 03 Sample quantity : 1.2611 gram

Sample type : UU Sample geometry : Detector name : 038 Detector geometry:

Elapsed live time: 0 02:50:00.00 Elapsed real time: 0 02:50:00.20 0.0%

Energy tolerance: 100.00 keV Half life ratio: 8.00
Errors propagated: Yes Systematic Error: 3.00 %

Abundance limit : 75.00

### Post-NID Peak Search Report

It	Energy	Area	FWHM	Channel	Left	Pw %Err	Fit	Nuclides	Activity pCi/gram
0	4170.59* 4382.42*		36.32 59.23	232.93 303.00	177 276	90 26.3 42193.9		U-238 U-235	0.650 2.069E-02
Ō	4460.58*	2	46.76	329.00	320	30141.4		U-236	2.493E-02
0	4745.05*	59	29.36	424.31	376	81 26.1		U-234	0.662
0	5293.66*	433	92.35	611.21	562	76 9.6		U232	4.88

### ALPHA SPECTROMETRY REPORT 12-JUL-2007 12:26:08

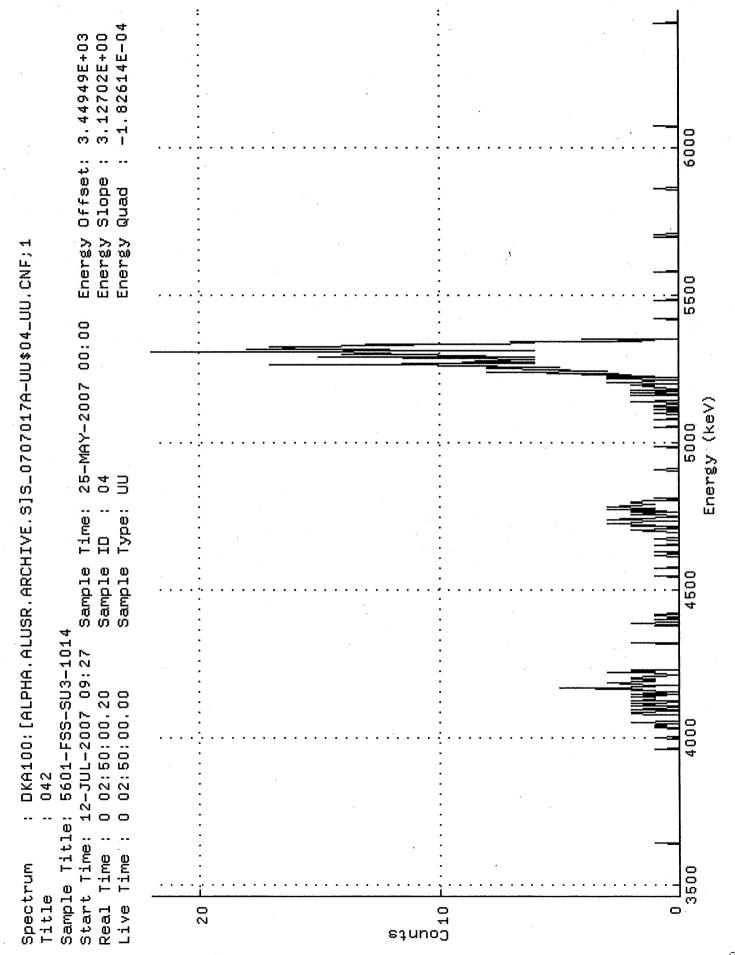
Spectral File: ND AMS ARCHIVE S:S 0707017A-UUS04 UU.CNF

BATCH ID: 0707017A-UU SAMPLE ID: 04 25 MAY-2007 00:00 SAMPLE DATE: ALIQUOT: 1.200E+00 gram SAMPLE TITLE: 5601-FSS-SU3-1014 DETECTOR NUMBER: 042 12-JUL-2007 09:27 ACO DATE: AVERAGE EFFICIENCY: 20.56% ELAPSED LIVE TIME: 10200. RECOVERY: 96.45% TRACER ID: UU-10A TRACER FWHM (kev): 75.62 LAMBDA VALUE: ROI TYPE: 615. STANDARD TRACER DPM AT SAMPLE DATE: 12.547 CONFIDENCE FACTOR: 4.65 SAMPLE MATRIX: SOIL LLD CONSTANT: 2.71 ENERGY CAL DATE: EFF CAL DATE: 6-JUL-2007 12:30 6-JUL-2007 12:30 BKG FILENAME: B 042 6JUL07 BKG ELAPSED TIME: 60000.

### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram	
U232	5302.5	421.66	0.34	99.8	4.709E+00	6.040E-01	6.047E-02	
U-234	4761.5	52.15	0.85	99.8	5.817E-01	1.834E-01	7.804E-02	
U-235	4385.5	8.00	0.00	80.9	1.101E-01	7.948E-02	3.729E-02	
U-236	4485.2	-0.17	0.17	90.1	-2.100E-03	4.212E-03	5.717E-02	
U-238	4184.4	69.32	0.68	100.2	7.699E-01	2.173E-01	7.268E-02	

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Channel					.*									
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Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:26:04.09

Detector ID: 42 Acquisition Start: 12-JUL-2007 09:27:33.01

Live Time: 0 02:50:00.00 Real Time: 0 02:50:00.20

Batch Id: 0707017A-UU Sample Id: 04

Sample Type: UU

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2 3 4	0 0 0	4149.69 4375.31 4476.54 4744.76 5285.40	70 8 0 53 422	0 0 01	71.92 0.00 L03.06	226.93 301.37 335.00 424.75 608.75	276 321 376	43 29 82	6.86E-03 7.84E-04 0.00E+00 5.20E-03 4.14E-02	35.4 0.0 13.7	

Background Counts Within Peak Regions Generated: 12-JUL-2007 12:26:06.58

Acquisition Start: 6-JUL-2007 15:30:58.01

Live Time: 0 16:40:00.00 Real Time: 0 16:40:00.10

Pk It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec %Err	Fit
1 0	4136.93	4	0181.05	222.50	178	90	6.67E-05 50.0	
2 0	4362.48	0	0 0.00	297.00	276	43	0.00E+00 0.0	
3 0	4476.76	· 1	0 3.12	335.00	321	29	1.67E-05100.0	
4 0		5	0234.12	416.50	376	82	8.33E-05 44.7	
5 · 0	5257.72	2	0 71.80	599.50	562	76	3.33E-05 70.7	

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 12:26:06.87

Pk I	t	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec %Err	Fit
1	0	4149.69*	69	0	59.67	226.93	178	90	6.80E-03 12.1	
2	0	4375.31*	. 8	0	71.92	301.37	276	43	7.84E-04 35.4	
3	0	4476.54*	0	0	0.00	335.00	321	29-	1.67E-05100.0	
4	0	4744.76*	52	01	L03.06	424.75	376	82	5.11E-03 14.0	
5	n	5285 40*	422	0	75.62	608.75	562	76	4.13E-02 4.9	

Flag: "\*" = Peak area was modified by background subtraction

### VMS Nuclide Identification Report V3.0 Generated 12-JUL-2007 12:26:07

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : 5601-FSS-SU3-1014

Sample date : 25-MAY-2007 00:00:00 Acquisition date : 12-JUL-2007 09:27:33

Sample ID : 04 Sample quantity : 1.2002 gram

Sample type : UU Sample geometry : Detector name : 042 Detector geometry:

Energy tolerance: 100.00 keV Half life ratio: 8.00 Errors propagated: Yes Systematic Error: 3.00 %

Abundance limit : 75.00

### Post-NID Peak Search Report

It	Energy	Area F	MHW (	Channel	Left	Pw %Err	Fit	Nuclides	Activity pCi/gram
0	4149.69*	69 59	67	226.93	178	90 24.2		U-238	0.743
0	4375.31*	8 71	92	301.37	276	43 70.7		U-235	0.106
0	4476.54*	0 0	0.00	335.00	321	29200.0		U-236	-2.026E-03
0	4744.76*	52103	.06	424.75	376	82 28.0		U-234	0.561
0	5285.40*	422 75	6.62	608.75	562	76 9.7		U232	4.54

Detector	Parameter	Flag	Filename
1	ALL	Passed	D 001 NONE
2	ALL	Passed	D 002 NONE
3	ALL	Passed	D_003_NONE
4	OFFLINE	- 400044	D_005_NOMB
5	OFFLINE		•
6	ALL	Passed	D 006 NONE
7	OFFLINE	- 45504	D_000_NONE
8	ALL	Passed	D 008 NONE
9	ALL	Passed	D 009 NONE
10	ALL	Passed	D 010 NONE
11	ALL	Passed	D 011 NONE
12	ALL	Passed	D 012 NONE
13	ALL	Passed	D 013 NONE
14	ALL	Passed	D 014 NONE
15	OFFLINE	_	D_011_W0MB
16	ALL	Passed	D 016 NONE
17	OFFLINE		
18	ALL	Passed	D 018 NONE
19	ALL	Passed	D 019 NONE
20	OFFLINE,		
21	OFFLINE 1		
• 22	OFFLINE		
23	ALL	Passed	D_023 NONE
24	OFFLINE		<del>-</del> -
25	ALL	Passed	D_025_NONE
26	OFFLINE	•	<del></del>
27	OFFLINE		
28	ALL	Passed	D 028 NONE
29	ALL	Passed	D 029 NONE
30	ALL	Passed	D_030_NONE
31	ALL	Passed	D_031_NONE
32	OFFLINE		
33	ALL	Passed	D_033_NONE
34	ALL	Passed	D_034_NONE
35	OFFLINE		
36	OFFLINE		
37	ALL	Passed	D_037_NONE
38 39	ALL	Passed	D_038_NONE
40	OFFLINE		
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46	ALL	Passed	D_045_NONE D_046_NONE
47	ALL	Passed	D_046_NONE D_047_NONE
48	ALL	Passed	D 047 NONE D 048 NONE
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APPROVAL TIME:

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PROCEDURE #

# SECTION VII ANALYTICAL DATA (ISOTOPIC THORIUM)

Eberline Services Oak Ridge Laboratory Analysis Sheet

07-07017 ThiSO Run 1

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ThisO Run 1

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Work Order	07-07017	Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
Analysis Code	ThISO	9	SOT	SOT		00:00 20/20/20	1.0000E+00
Run	7-	05	MBL	BLANK		00:00 20/90/20	1.0000E+00
Date Received	7/5/2007	03	DUP	5601-FSS-SU3-1014	49	05/25/07 09:45	1.0468E+00
Lab Deadline	7/26/2007	04	00	5601-FSS-SU3-1014	49	05/25/07 09:45	1.0333E+00
Client	Environmental Chemical Corporation			And the second s			
Project	Li Tungsten						
Report Level	4						
Activity Units	pCi						
Aliquot Units	Б						
Matrix	OS						
Method	EML Th-01 Modified		-				
Instrument Type	Alpha Spectroscopy						
Radiometric Tracer	Th-229					^	
Radiometric Sol#	Th-18a	٠			, <b>3</b>		
Tracer Act (dpm/g)	22.478		-	•			
Carrier		·	-				
Carrier Conc (mg/ml)						-	

Printed: 7/12/2007 5:58 AM Page 2 of 3

07-07017 ThISO Run 1

Eberline Services Oak Ridge Laboratory Analysis Sheet

SAF 2\* SAF 1\* Mean % Rec Grav % Rec Grav Filter Net (g) Grav Filter Final (g) Grav Filter Tare (g) Grav Carrier Added (ml) Radiometric % Rec Radiometric Tracer (pCl) 5.2 5.2 5.2 5.2 Tracer Total ACT (dpm) 0.2325 0.2317 Tracer Aliquot (g) 0.2327 0.2327 Sample Desc CS MBL DUP 8 Internal Fraction 5 02 93 9

Eberline Services Oak Ridge Laboratory Analysis Sheet

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07-07017 ThISO Run 1

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Printed: 7/13/2007 11:48 AM Page 1 of 3

Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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MDA	1.40E-01	2.16E-01	1.67E-01	1.16E-01															
Error Estimate	1.14E+00	1.36E-01	2.87E-01	2.99E-01															
Results	4.97E+00	1.23E-01	7.57E-01	8.69E-01															
Activity Units	pCl/g	pCI/g	pCI/g	pCi/g		-													
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# Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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Radiometric % Rec	86.47	49.34	72.44	77.10													
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Sample Date	07/05/07 00:00	07/05/07 00:00	05/25/07 09:45	05/25/07 09									-	:			
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Sample	CS	MBL.	DUP	8													
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Nuclide	TH-228	TH-228	TH-228	TH-228													
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Lab Fraction	01	02	03	94													
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	uny	Analysis Code	Eberline Services Work Order	Client

EH EH	19.9	20.3	20.7	21.3											
Bkg CPM	1.10 E-02	8.00 E-03	1.40 E-02	6.00 E-03				and the same of th							The state of the s
Counts	170.07 3.20 E+02	170.02 4.64 E+00	170.02 4.26 E+01	170.03 5.30 E+01				The second secon							
Count	170.07	170.02	170.02	170.03											
Carrier	6	10	1	12											
Detect	A_Spec	A_Spec	A_Spec	A_Spec	Control of the Contro										
Haiflife (days)				÷	-							:			
Counting Date/Time	07/12/07 12:37	07/12/07 12:37	07/12/07 12:37	07/12/07 12:38								-			•
Sample Desc	SOT	MBL	DUP	8								_		•	
Nuclide	TH-228	TH-228	TH-228	TH-228					-		-		-		
Lab Fraction	2	02	03	40											

**71070-70** 

Eberline Services Work Order

**OSI41** 

Analysis Code

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Environmental Chemical Corporation

Client

Printed: 7/13/2007 11:48 AM Page 1 of 3

Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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MDA	1.01E-01	1.60E-01	1.02E-01	9.44E-02															<u> </u>	
Error Estimate	1.23E+00	1.36E-01	3.01E-01	2.75E-01																
Results	5.41E+00	1.46E-01	8.56E-01	7.90E-01			à.													
Activity Units	pCI/g	bCl/g	pCi/g	pCI/g																
Client Identification	SOT	BLANK	5601-FSS-SU3-1014	5601-FSS-SU3-1014											-					
Sample Desc	SOT	MBL	DUP	8				•			-					_				
Nuclide	TH-230	TH-230	TH-230	TH-230																
Lab Fraction	2	07	03	04			•													

<b>9</b> 00	L	OSI4T	71070-70	Environmental Chemical Corporation
	บทษ	Analysis Code	Eberline Services Work Order	Client

Printed: 7/13/2007 11:48 AM Page 2 of 3

# Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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	uny	Analysis Code	Eberline Services Work Order	Client

# Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

Eberline Services Oak Ridge Laboratory

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5	19.9	20.3	20.7	21.3		and the second second second									
Bkg	4.00 E-03	3.00 E-03	3.00 E-03	3.00 E-03											
Counts	170.07 3.50 E+02	170.02 5.49 E+00	170.02 5.05 E+01	170.03 5.05 E+01							-				
Count	170.07	170.02	170.02	170.03											
Carrier	<b>o</b>	0,	F	27											
Detect	A_Spec	A_Spec	A_Spec	A_Spec									·		
Hatfilfe (days)								-		·					
Counting Date/Time	07/12/07 12:37	07/12/07 12:37	07/12/07 12:37	07/12/07 12:38									-		
Sample Desc	SOT	MBL	DUP	8								-			
Nuclide	TH-230	TH-230	TH-230	TH-230											
Lab	2	02	83	9											

71070-70

Eberline Services Work Order

**OSI4T** 

Analysis Code

Run

Environmental Chemical Corporation

Client

Printed: 7/13/2007 11:48 AM Page 1 of 3

Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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LCS Known	4.76E+00									<del></del>			······						
MDA	1.01E-01	1.60E-01	9.17E-02	4.23E-02															
Error Estimate	1.21E+00	7.72E-02	2.39E-01	2.86E-01															
Results	5.34E+00	3.95E-02	6.03E-01	8.43E-01								-							
Activity Units	pCI/g	pCI/g	bCl/g	pCI/g														1	
Client Identification	SOT	BLANK	5601-FSS-SU3-1014	5601-FSS-SU3-1014										-					
Sample Desc	SOT	MBL	PUP	8											<u>.</u>			<del>,</del>	
Nuclide	TH-232	TH-232	TH-232	TH-232				-											
Lab Fraction	5	02	03	90															

900	L	OSIYL	71070-70	Environmental Chemical Corporation
	Run	Analysis Code	Eberline Services Work Order	Client

Printed: 7/13/2007 11:48 AM Page 2 of 3

Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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Sep to Date/Time	7/12/2007 5:58	7/12/2007 5:58	7/12/2007 5:58	7/12/2007 5:58															
SAF														5.					
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Grav % Rec																			
Radiometric % Rec	86,47	49,34	72.44	77.10															
Sample Aliquot	1.00E+00	1.00E+00	1.05E+00	1.03E+00															
Sample Date	07/05/07 00:00	07/05/07 00:00	05/25/07 09:45	05/25/07 09:45											-			-	
Sample Desc	rcs	MBL	DUP	8												-			
Nuclide	TH-232	TH-232	TH-232	TH-232		-													
Fraction	2	02	03	40		``						:							

<b>60</b>	L	ОЗІЧТ	<b>T1070-70</b>	Environmental Chemical Corporation
	Run	Analysis Code	Eberline Services Work Order	Client

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Run

### 19.9 20.3 20.7 27.3 0.00 E+00 3.00 E-03 4.00 E-03 2.00 E-03 CPM CPM 170.07 3.46 E+02 170.02 1.49 E+00 170.03 5.40 E+01 170.02 3.57 E+01 Counts Count Carrier 10 F 72 G A\_Spec A\_Spec A\_Spec A\_Spec Halfilfe (days) 07/12/07 12:37 07/12/07 12:38 07/12/07 12:37 07/12/07 12:37 Counting Date/Time Sample Desc S 징 MBL 8 TH-232 TH-232 TH-232 TH-232 Nuclide Lab Fraction 2 07 6 94

**71070-70** 

Eberline Services Work Order

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Analysis Code

Environmental Chemical Corporation

Client

Printed: 7/13/2007 11:48 AM. Page 1 of 3

Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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		1								<u> </u>												
Error Estimate		7.95E-02	1.03E-01	9.48E-02																		
Results		3.59E-02	1.19E-01	1.15E-01																		
Activity Units		pCi/g	pCI/g	pCl/g.															:			:
Cllent Identification		BLANK	5601-FSS-SU3-1014	5601-FSS-SU3-1014	•																	
Sample Desc		MBL	DUP	8						· · · · · · · · · · · · · · · · · · ·		-	+		14			1				
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Nuclide		TH-227	TH-227	TH-227		:										·						
Lab Fraction	•	02	03	04								•				-				•		,

<b>9</b> 00	L	OSIYL	71070-70	Environmental Chemical Corporation
	uny	Analysis Code	Eberline Services Work Order	Client

Printed: 7/13/2007 11:48 AM Page 2 of 3

# Preliminary Data Report & Analytical Calculations Work Order: 07-07017-ThISO-1

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SAF										5		-		
Mean % Rec														
Grav % Rec											•			
Radiometric % Rec		49.34	72.44	77.10								:		
Sample Aliquot		1.00E+00	1.05E+00	1.03E+00										
Sample Date		07/05/07 00:00	05/25/07 09:45	05/25/07 09:45				-						
Sample Desc		MBL	a Do	00								-		
Nuclide		TH-227	TH-227	TH-227			•							
Lab Fraction	•	02	03	40						-		7		

9,0	L	OSIYL	71070-70	Environmental Chemical Corporation
	Run	Analysis Code	Eberline Services Work Order	Client

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**uny** 

### 20.3 21.3 20.7 畫 4.00 E-03 7.00 E-03 5.00 E-03 Bkg CPM 170.02 6.81 E+00 170.02 1.32 E+00 170.03 7.15 E+00 Counts Count Carrier 9 Ξ 7 A\_Spec A\_Spec A\_Spec Defect Halfiife (days) 07/12/07 12:37 07/12/07 12:37 07/12/07 12:38 Sample Desc MBL DUP 8 TH-227 TH-227 TH-227 Nuclide Lab Fraction 9 02 6

**71070-70** 

Eberline Services Work Order

ОЅІЧІ

Analysis Code

Environmental Chemical Corporation

Client

07-07017-ThISO-1 (pCi/g) in SO Tracer ID: Th-18a

Count Room Report
Client: Environmental Chemical Co

SAF 2*													-		
SAF 1*	*										-				
Radiometric % Rec															
Radiometric Tracer (pCi)															
Tracer ACT (dpm)	5.2306	5.2306	5.2261	5.2082					.1						
Tracer Aliquot (g)	0.2327	0.2327	0.2325	0.2317						-				-	
Sample Aliquot	1.0000	1.0000	1.0468	1.0333							:				
Sample Date	07/05/07 00:00	00:00 20/50/20	05/25/07 09:45	05/25/07 09:45											
Client ID	SOT	BLANK	5601-FSS-SU3-1014	5601-FSS-SU3-1014								- -			
Sample Desc	rcs	MBL	DUP	00		:		2			-				
Internal Fraction	Б	05	. 03	97											

Spike and Tracer Worksheet

Printed: 7/6/2007 6:50 AM

Eberline Services Oak Ridge Laboratory

	Internal W	ork Order		Run	Analysis	Code	Date	e		Technician	cian		Technicia	echnician Initials	Witness	itness Initials
	0-20	7-07017		<b>,</b> -	This	hISO	7/6/200	/6/2007 6:47		JBARNARD	VARD		G	<u>^</u>		
	LCS	: Matrix Sp	ikes		SOT	MS	Losp	MSD	)-T	S	M	9	10T	l os	WS	Q
Isotope	# JoS	Activity dpm/g	Solution Date	Approx Addition	Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Known	Error Estimate	Added pCi	Error Estimate	Known	Estimate	Added pCl	Error Estimate

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Estimate	0.000	0.000	0.000															-					
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Estimate	0.000	0.000	0.000		SOT				_		A Company				Matrix Spike				•				
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Estimate	0.171	0.144	0.171	Rala								æ											
bCi w	4.76	5.32	4.76		Tracer					-	n o ∵ Ki												
Volume Used (g)										0.2327	8.2329 8.2325	0,2317											
Volume Used (g)														-									
Volume Used (g)					Approx	0.4600	0.4600	0.4600	0.4600														
Volume Used (g)	0.1021	0.5016	0,1021		Volume Head (n)	0.2327	0.2327	0.2325	0,2317														
Approx	0.100	0.500	0.100		Solution	7/6/2007	7/6/2007	7/6/2007	7/6/2007							,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				\$.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\			
Solution	7/6/2007	7/6/2007	7/6/2007	Tespores	Activity dom/a	22.478	22.478	22.478	22.478										-			,	
Activity dpm/g	103.560	23.527	103.560		#/oS	Th-18a	Th-18a	Th-18a	Th-18a														
% los	Th-8b	Th-1b	Th-8b		Isotope	Th-229	Th-229	Th-229	Th-229														
Isotope	Th-228	Th-230	Th-232		fraction	20	02	03	40														

Printed: 7/6/2007 9:04 AM Page 1 of 1

# **Aliquot Worksheet**

Eberline Services - Oak Ridge Version 2.0 8/1999

**JBARNARD** Technician Lab Deadline 7/26/2007 grams Rpt Units Analysis Code Thiso Run 07-07017 Work Order

40	Environmental Chemical Corporation Sample	Sample	Muffle Data		Dilution Data		Alique	Aliquot Data	MS Ali	MS Aliquot Data	H-3 Soli	H-3 Solids Only
Fraction		Type	Ratio Post/Pre	No of Dils	Dill Factor	Ratio	Allquot	Net Equiv	Allquot	Net Equiv	Water Added (ml)	H3 Dist Aliq
۶	CCS	SOT					1.0000E+00					
02	BLANK	MBL					1.0000E+00	1.0000E+00				
8	5601-FSS-SU3-1014	DOP					1.0468E+00	1.0468E+00				
8	5601-FSS-SU3-1014	8					1.0333E+00	1.0333E+00				
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Eberline Services - Oak Ridge Prep Logbook Version 2.0 8/1999

Rough Sample Preparation

Log Book

Page 1 of 1

Printed: 7/6/2007 8:29 AM

Special Info **JPACHELLA** Technician LEPS Wt. Gamma Dry Wt. Solid Date Returned 7/7/2007 Percent Liquid 1526,7600 7/6/2007 Date Sealed Net (g) 1866,2500 Wet Wt. Dry Wt. 1555.1600 Date Received in Prep 7/5/2007 Gross (g) Wet Wt. 1894.6500 28.4000 7/26/2007 Lab Deadline Tare (g) Pan Wt Eberline Environmental Chemical Corporation Client ID 5601-FSS-SU3-1014 07-07017 Fraction 40

mments)	zard, R: Rush, T: Other (see co	H; Hot, O: Organic Hazard, P: PCB Ha	Special Codes
			)
-			Comments
-			

Analysis: ThISO Page No. 5721 Date: Analysis: Rough Prep Logbook

111

### ALPHA SPECTROMETRY REPORT 12-JUL-2007 15:46:23

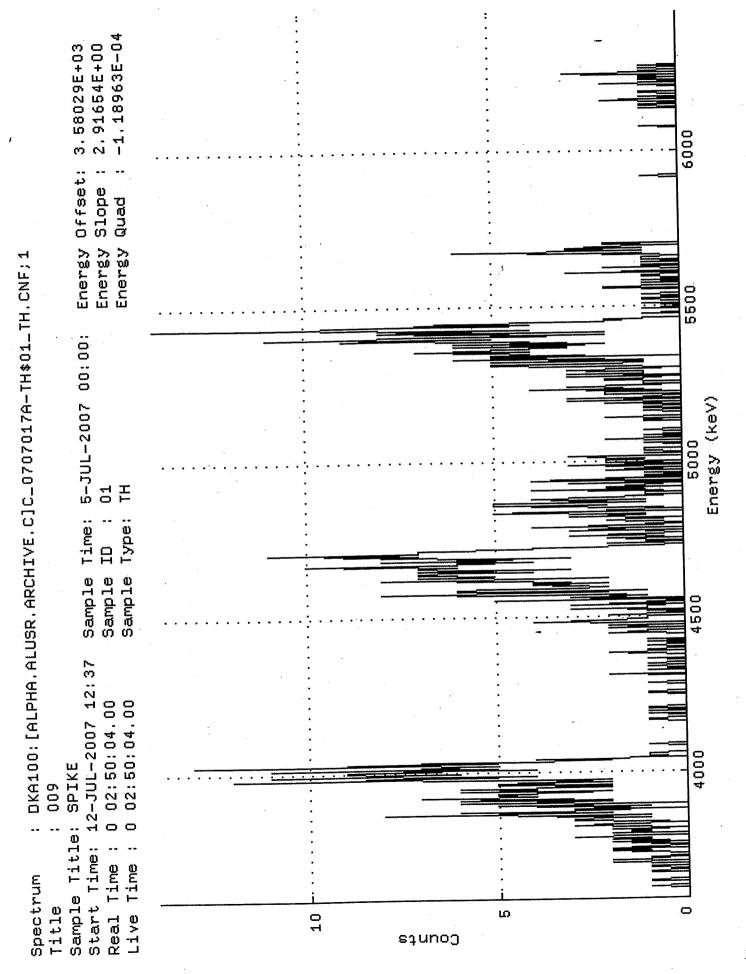
BATCH ID:	0707017A-TH	*	SAMPLE ID:	01
SAMPLE DATE:	5-JUL-2007 00:00	*	ALIQUOT: 1.000E+0	0 gram
SAMPLE TITLE:	SPIKE	*	DETECTOR NUMBER:	009
ACQ DATE:	12-JUL-2007 12:37	*	AVERAGE EFFICIENCY:	19.88%
ELAPSED LIVE TIME		*	RECOVERY:	86.47%
TRACER ID:	TH-18A	*	TRACER FWHM (kev):	263.43
LAMBDA VALUE:	233.	*	ROI TYPE:	STANDARD
TRACER DPM AT SAM	MPLE DATE: 5.230	*	CONFIDENCE FACTOR:	4.65
SAMPLE MATRIX:	SOIL	*	LLD CONSTANT:	2.71
ENERGY CAL DATE:	6-JUL-2007 07:08	*	EFF CAL DATE: 6-JUL-20	07 07:08
BKG FILENAME:	B 009 6JUL07	*	BKG ELAPSED TIME:	60001.
	· _ · _ · _ · .	_	•	

### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
TH-227	5850.0	-0.36	1.36	97.5	-5.702E-03	3.512E-02	1.286E-01
TH-228	5400.0	320.13	1.87	99.9	4.974E+00	1.140E+00	1.399E-01
TH229	4872.0	152.15	0.85	99.5	2.356E+00	4.417E-01	1.084E-01
TH-230	4672.0	350.32	0.68	99.8	5.408E+00	1.227E+00	1.010E-01
TH-232	3997.0	346.32	0.68	100.0	5.337E+00	1.212E+00	1.009E-01

\*\*\* Tracer FWHM > 80.0 Kev

Analyst



Channel																
1:	10204	10204	o	0	0	0	0	0 *	0	0	0	0		0		0
15:	0	1	0	0	0	0	0	1 0	1	0 1	0	0		0		0
29: 43:	0 2	0	0 2	1 1	1	0	1	0	0	Ó	ŏ	ĭ		2		1
57:	2	ŏ	2	i	o	1	Ò	1	2	0	1	2		1	•	1
71:	3	1	0	0	0	2	1	1	2	1	0	2		1		3
85:	2	2	0	1	3	3 2	3	2 3	1 5	3	4 6	1		8 2		2
99: 113:	6 2	3 4	3 7	0 6	3 4	5	4	5	3	2	6	4		4		6
127:	2	2	5	2	5	4	2	3	4	2	12	5		6		4
141:	11	6	8	9	8	9	4	11 1	5 1	.7 1	5	8 0		13 0		5 0
155: 169:	7	5 0	2 0	4 0	3 0	0 1	0	Ó	Ó	ó	Ö	0		ŏ		Ŏ
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197:	0	0	0	0	1	1	1	0	0	0	0	1		0		0
211:	0	1 0	0 0	1 0	0	1 0	0	0	0	0	0 0	0		0		0
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323:	0	1	0	0	3	1	1	1	0	3	1	· · · · 0		1		0 5
337:	0 3	5 2	0 3	3 3	3 4	1 2	2	3	8 5	3 4	8	2		3		7
351: 365:	5	7	6	7	6	4	7	3	6	7	7	6	•	8	1	10
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505:	1	0	1	1	1	1 0	0	0 1	0 0	0	0	1		0		0
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575: 589:	2 2	0	1	4 1	1 0	2 3	0	3	1	1	i	ž		3		1
603:	1	ō	2	3	5	5	2	1 .	1	5	1	6		2		5
617:	.5	0	5	4	4	5	7	4	6	4	5 5	3		3 3		6
631:	3	2	6 7	3	5 8	4 8	9 11	5 14	6 5	11 4	7	é		3		2
645: 659:	2	1	2	ō	Õ	0	Ö	0	1	Ó	0	(		0		0
673: 687:	1	. 0	0	0	0 -	1	0	0	0 -	0	1	Ç		1		0
687:	0	0	1	0	0 0	.0 1	0	0	0	2 1	0 1			0		0
701: 715:	0 3	0	1 0 .	0 0	0	. 1	2	Ŏ	1	ò	. 0	Ó		1		0
715: 729: 743:	Ō	1	1	1	1	0	1	2	1	2	6	1		1		3
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757:	0	0	0	0 0	0	0	0	0	0	0	0		j ·	ŏ		0
771: 785: 799:	0	ŏ	Ŏ	ŏ	Ŏ	0	0	0	0	0	.0		)	0	•	0
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813:	. 0	0	0	0	0	0	0	0	0 0	0	0		)	0		0
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869:	0	0	0	0	0	0	0	0	0	0	0		D D	0	-	0
883: 897:	0	0	0 0	0	1 0	0	0	0 0	0 0	0	0		0	1		0
911:	0	1	0	1	0	1	0	2	1	0	0		1	0		
925:	0	0	1	1	0	0	. 0	0	0	Ó	0		1	0		0 2 1
939:	0	1	0	1 .	0	1 0	1 0	0 1	1 0	0	2		3 0	0		Ó
953: 967:	1 0	0	0 0	1 0	1 0	0	0	.0	0	0	Ö	1	0	0		Ō
981:	0	0	0	0	0	0	0	0	0	0	. 0		0	0		0
995:	0	0	0	.0	0	0 0	0	0	0 0	0	0		0 0	0		0 0 0 0
1009: 1023:	0 0	0	0	0	0	U	U	,U	J	U			•	3		
, ,,,,,,,	J	•														

Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:20.26

Detector ID: 9 Acquisition Start: 12-JUL-2007 12:37:10.01

Live Time: 0 02:50:04.00 Real Time: 0 02:50:04.00

Batch Id: 0707017A-TH Sample Id: 01

Sample Type: TH

Pk	It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2 3 4	0 0 0	3951.03 4633.53 4882.55 5356.83 5913.62	347 351 153 322 1		366.61	293 399 551	107 135 109	3.40E-02 3.44E-02 1.50E-02 3.16E-02 9.80E-05	5.3 8.1 5.6	

Background Counts Within Peak Regions Generated: 12-JUL-2007 15:46:22.19

Acquisition Start: 6-JUL-2007 15:28:24.01

Live Time: 0 16:40:01.00 Real Time: 0 16:40:01.00

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	3952.67	4	0,2	00.74	128.00	76	105	6.67E-05	50.0	
2	0	4575.27	4	02	56.02	346.00	293	107	6.67E-05	50.0	
		4913.43	. 5	02	15.29	466.00	399	135	8.33E-05	44.7	
4	0	5301.07	11	03	05.48	605.00			1.83E-04		
5	0	5875.76	.8	01	42.56	814.00	7.50	129	1.33E-04	35.4	

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:22.44

Pk	It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	3951.03*	346	0170.43	127.78			3.39E-02		
2	0	4633.53*	350	0149.09	366.61	293	107	3.43E-02	5.3	
3	0	4882.55*	152	0263.43	454.95			1.49E-02		
4	0	5356.83*	320	0 47.01	625.07			3.14E-02		
5	0	5913.62*	0	0 2.92	828.00	750	129	-3.53E-05	307.8	

Flag: "\*" = Peak area was modified by background subtraction

# VMS Nuclide Identification Report V3.0 Generated 12-JUL-2007 15:46:23

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : SPIKE

Sample date : 5-JUL-2007 00:00:00 Acquisition date : 12-JUL-2007 12:37:10

Sample ID : 01 Sample quantity : 1.0000 gram

Sample type : TH Sample geometry : Detector name : 009 Detector geometry:

Elapsed live time: 0 02:50:04.00 Elapsed real time: 0 02:50:04.00 0.0%

Energy tolerance: 100.00 keV Half life ratio: 8.00 Errors propagated: Yes Systematic Error: 3.00 %

Abundance limit: 75.00

### Post-NID Peak Search Report

It	Energy	Area FWHM Char	nel Left Pw %Err	Fit	Nuclides	Activity pCi/gram
0 0 0 0	3951.03* 4633.53* 4882.55* 5356.83* 5913.62*	350149.09 366 152263.43 454 320 47.01 625	7.78 76 105 10.8 5.61 293 107 10.7 3.95 399 135 16.3 5.07 551 109 11.2 750 129615.6		TH-232 TH-230 TH229 TH-228 TH-227	4.61 4.68 2.04 4.30 -4.930E-03

### ALPHA SPECTROMETRY REPORT 12-JUL-2007 15:46:35

BATCH ID: 0707017A-TH SAMPLE ID: 02 SAMPLE DATE: 12-JUL-2007 00:00 ALIOUOT: 1.000E+00 gram SAMPLE TITLE: DETECTOR NUMBER: BLANK 010 12-JUL-2007 12:37 ACQ DATE: AVERAGE EFFICIENCY: 20.27% ELAPSED LIVE TIME: 10201. RECOVERY: 49.34% TRACER ID: TRACER FWHM (kev): TH-18A 86.40 LAMBDA VALUE: 233. ROI TYPE: STANDARD TRACER DPM AT SAMPLE DATE: 5.230 CONFIDENCE FACTOR: 4.65 SAMPLE MATRIX: SOIL LLD CONSTANT: 2.71 ENERGY CAL DATE: 6-JUL-2007 07:08 EFF CAL DATE: 6-JUL-2007 07:08 BKG FILENAME: B 010 6JUL07 BKG ELAPSED TIME: 60005.

\*

### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
TH-227	5850.0	1.32	0.68	97.5	3.588E-02	7.954E-02	1.779E-01
TH-228	5400.0	4.64	1.36	99.9	1.231E-01	1.358E-01	2.156E-01
TH229	4872.0	88.49	0.51	99.5	2.356E+00	5.485E-01	1.606E-01
TH-230	4672.0	5.49	0.51	99.8	1.457E-01	1.357E-01	1.601E-01
TH-232	3997.0	1.49	0.51	100.0	3.948E-02	7.715E-02	1.598E-01
*****	*****	*****					

\*\*\* Tracer FWHM > 80.0 Kev \*\*\*

Analyst

1

Reviewer

7/12/07

Date

Date

6500 -1,65457E-04 3,48628E+03 3.11364E+00 6000 Offset: Energy Offset: Energy Slope : Energy Quad : DKA100: [ALPHA.ALUSR.ARCHIVE.R]R\_0707017A-TH\*02\_TH.CNF;1 5500 12-JUL-2007 00:00 Energy (keV) 5000 Ξ Time: Sample ID : Sample Type: Sample 4500 12-JUL-2007 12:37 0 02:50:01.00 0 02:50:01.00 4000 010 BLANK Sample Title: Live Time : Start Time: Real Time Spectrum 3500 Title ø Ŋ squnoj

Channel								·						** **
1: 15: 29: 43: 57: 71: 85: 99: 113: 127: 141: 155: 183: 197: 211: 225: 239: 267: 281: 295: 295: 309: 407: 403: 407: 403: 407: 403: 505: 519	10201 000000000000000000000000000000000	10201 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	00000000000000000001000010000201011002000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	0000000100000000000010000010101130200000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000

Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:31.77

Detector ID: 10 Acquisition Start: 12-JUL-2007 12:37:22.01

Live Time: 0 02:50:01.00 Real Time: 0 02:50:01.00

Batch Id: 0707017A-TH Sample Id: 02

Sample Type: TH

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2	0 0	3917.41 4627.14 4889.53 5257.95	2 6 89 6	0	0.00 86.40	139.50 373.83 462.02 587.33	306 407 550	102 127 104	1.96E-04 5.88E-04 8.72E-03 5.88E-04	40.8 10.6 40.8	
-	-	5867.02	2	01	74.36	798.50	740	124	1.96E-04	70.7	

Background Counts Within Peak Regions Generated: 12-JUL-2007 15:46:33.89

Acquisition Start: 6-JUL-2007 15:28:27.01

Live Time: 0 16:40:05.00 Real Time: 0 16:40:05.00

Pk	It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	3949.70	3	0 18.22				5.00E-05		
		4574.71	3	0260.56	356.50			5.00E-05		
		4912.84	3	0269.86	470.00			5.00E-05		
_	-	5299.82	· 8	0189.22	601.50			1.33E-04		
_	_	5878.52	4	0254.35	801.50	740	124	6.67E-05	50.0	

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:34.19

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2 3 4	0 0 0	3917.41* 4627.14* 4889.53* 5257.95* 5867.02*	1 5 88 5 1	0 0 0	0.00 86.40 3.11	139.50 373.83 462.02 587.33 798.50	306 407 550	102 127 104	1.46E-04 5.38E-04 8.67E-03 4.55E-04 1.29E-04	44.9 10.7 53.8	, v., v., v., v., v., v., v., v., v., v.

Flag: "\*" = Peak area was modified by background subtraction

# VMS Nuclide Identification Report V3.0 Generated 12-JUL-2007 15:46:35

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : BLANK

Sample date : 12-JUL-2007 00:00:00 Acquisition date : 12-JUL-2007 12:37:22

Sample ID : 02 Sample quantity : 1.0000 gram

Sample type : TH Sample geometry : Detector name : 010 Detector geometry:

Energy tolerance: 100.00 keV Half life ratio: 8.00 Errors propagated: Yes Systematic Error: 3.00 % Efficiency type: Average value Efficiencies at: Peak Energy

Abundance limit : 75.00

## Post-NID Peak Search Report

It	Energy	Area FWHM	Channel	Left	Pw %Err	Fit	Nuclides	Activity pCi/gram
0 0 0 0	3917.41* 4627.14* 4889.53* 5257.95* 5867.02*	1105.86 5 0.00 88 86.40 5 3.11 1174.36	139.50 373.83 462.02 587.33 798.50	407 550	99193.9 102 89.9 127 21.3 104107.6 124220.4		TH-232 TH-230 TH229 TH-228 TH-227	1.948E-02 7.190E-02 1.16 6.073E-02 1.770E-02

# ALPHA SPECTROMETRY REPORT 12-JUL-2007 15:46:46

03
gram
011
20.66%
72.44%
151.47
TANDARD
4.65
2.71
7 07:08

BKG FILENAME: B\_011\_6JUL07 \* BKG ELAPSED TIME: 60002.

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
TH-227	5850.0	6.81	1.19	97.5	1.186E-01	1.028E-01	1.350E-01
TH-228	5400.0	42.62	2.38	99.9	7.569E-01	2.871E-01	1.673E-01
TH229	4872.0	132.32	0.68	99.5	2.249E+00	4.446E-01	1.112E-01
TH-230	4672.0	50.49	0.51	99.8	8.555E-01	3.014E-01	1.022E-01
TH-232	3997.0	35.66	0.34	100.0	6.031E-01	2.393E-01	9.170E-02

\*\*\* Tracer FWHM > 80.0 Kev \*\*

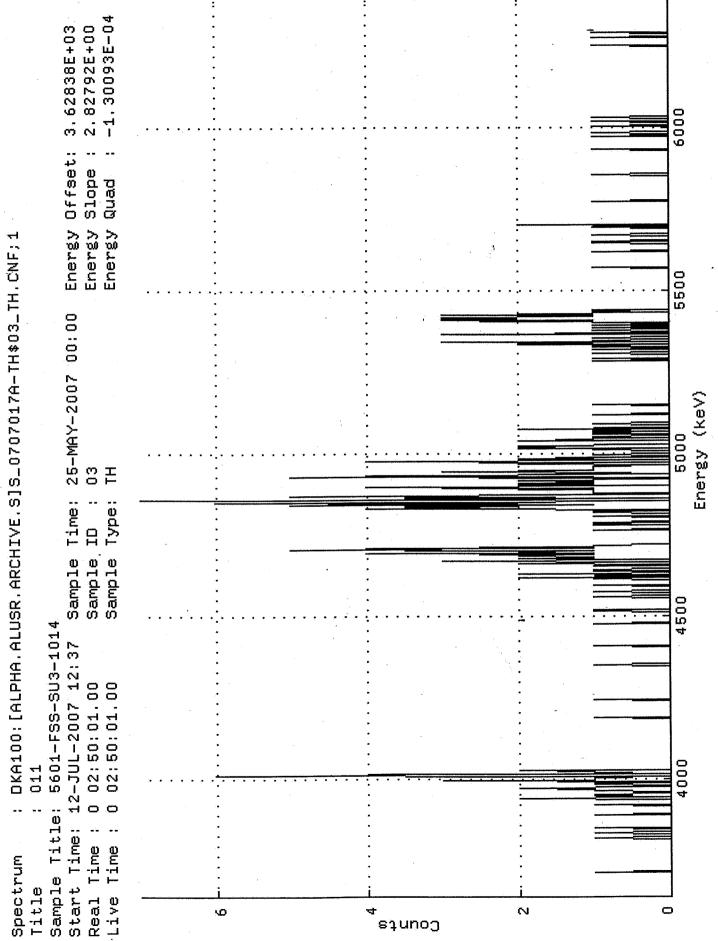
Analyst

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7/12/07 Date

7/13/07

Date



Channel												•		
1: 15: 29: 43: 57: 71: 85: 99: 113: 127: 141: 155: 169: 183: 197: 211: 225: 239: 239: 237: 241: 295: 309: 323: 379: 407: 41: 435: 449: 471: 471: 575: 589: 617: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 771: 785: 785: 771: 785: 771: 785:	10201 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	10201 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000001001000000000000000000000000000000	0000000000000000000011040011101101000000	0000001010000000000000011000311110000100002010000010000100000000	0000000010000001000000202000610000200001030000000000	000000011000000000000000011000315002000003130000000000	000001001000000000000000000000000000000	000000101100000100000000000000001131400100000010100000000	0000000260000000001101131010740110000000110000010000000000	_00001000020000000000000000000000000000	000000000000000000000000000000000000000	000000201000000001000001210032220210000010110000001000000100000000	00000001100000000000001110045132100000010000001000000000000000000000

Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:41.23

Detector ID: 11 Acquisition Start: 12-JUL-2007 12:37:41.01

Live Time: 0 02:50:01.00 Real Time: 0 02:50:01.00

Batch Id: 0707017A-TH Sample Id: 03

Sample Type: TH

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2 3 4	0 0	3972.62 4660.87 4911.04 5383.07 5944.64	36 51 133 45 8	0 01 0	44.29 51.47 98.94	122.42 371.45 463.45 639.29 852.50	285 395 552	111 139 113	3.53E-03 5.00E-03 1.30E-02 4.41E-03 7.84E-04	14.0 8.7 14.9	

Background Counts Within Peak Regions Generated: 12-JUL-2007 15:46:44.28

Acquisition Start: 6-JUL-2007 15:28:30.01

Live Time: 0 16:40:02.00 Real Time: 0 16:40:02.00

Pk	It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	3950.81	2	0124.56	114.50	61	108	3.33E-05	70.7	
2	0	4576.07	3	0141.55	340.00			5.00E-05		
3	0	4914.34	4	0115.72	464.00	395	139	6.67E-05	50.0	
4	0	5302.23	14	0 2.83	608.00	552	113	2.33E-04	26.7	
5	0	5879.35	7	0 4.16	826.00	759	135	1.17E-04	37.8	

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:44.55

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	.0	3972.62*	36	0	3.81	122.42	61	10.8	3.50E-03	16.8	
2	0	4660.87*	50	0	44.29	371.45	285	111	4.95E-03	14.2	
3	0	4911.04*	132	01	151.47	463.45	395	139	1.30E-02	8.7	
4	0	5383.07*	43	0	98.94	639.29	552	113	4.18E-03	15.8	
5	0	5944.64*	7	02	282.79	852.50	759	135	6.68E-04	42.1	

Flag: "\*" = Peak area was modified by background subtraction

# VMS Nuclide Identification Report V3.0 Generated 12-JUL-2007 15:46:45

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : 5601-FSS-SU3-1014

Sample date : 25-MAY-2007 00:00:00 Acquisition date : 12-JUL-2007 12:37:41

Sample ID : 03 Sample quantity : 1.0468 gram

Sample type : TH Sample geometry :

Detector name : 011 Detector geometry:

Energy tolerance: 100.00 keV Half life ratio: 8.00
Errors propagated: Yes Systematic Error: 3.00 %
Efficiency type: Average value Efficiencies at: Peak Energy

Abundance limit : 75.00

## Post-NID Peak Search Report

It	Energy	Area FWHM	Channel	Left	Pw	%Err	Fit	Nuclides	Activity pCi/gram
0	3972.62*	36 3.81	122.42	61	108	33.7		TH-232	0.437
0	4660.87*	50 44.29	371.45	285	111	28.3		TH-230	0.620
0	4911.04*	132151.47	463.45	395	139	17.4		TH229	1.63
0	5383.07*	43 98.94	639.29	552	113	31.6		TH-228	0.548
0	5944.64*	7282.79	852.50	759	135	84.1		TH-227	8.593E-02

# ALPHA SPECTROMETRY REPORT 12-JUL-2007 15:46:55

\* Spectral File: ND AMS ARCHIVE S:S 0707017A-TH\$04 TH.CNF BATCH ID: 0707017A-TH SAMPLE ID: 04 SAMPLE DATE: 25-MAY-2007 00:00 ALIQUOT: 1.033E+00 gram SAMPLE TITLE: 5601-FSS-SU3-1014 DETECTOR NUMBER: 012 ACQ DATE: 12-JUL-2007 12:38 AVERAGE EFFICIENCY: 21.29% ELAPSED LIVE TIME: 10202. RECOVERY: 77.10% TRACER ID: TH-18A TRACER FWHM (kev): 14.38 LAMBDA VALUE: 232. ROI TYPE: STANDARD TRACER DPM AT SAMPLE DATE: 5.208 CONFIDENCE FACTOR: 4.65 SAMPLE MATRIX: SOIL LLD CONSTANT: 2.71 ENERGY CAL DATE: 6-JUL-2007 07:09 EFF CAL DATE: 6-JUL-2007 07:09

NUCLIDE ACTIVITY SUMMARY

BKG ELAPSED TIME:

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
TH-227	5850.0	7.15	0.85	97.5	1.150E-01	9.475E-02	1.121E-01
TH-228	5400.0	52.98	1.02	99.9	8.689E-01	2.990E-01	1.158E-01
TH229	4872.0	144.66	0.34	99.5	2.270E+00	4.332E-01	8.509E-02
TH-230	4672.0	50.49	0.51	99.8	7.900E-01	2.753E-01	9.437E-02
TH-232	3997.0	54.00	0.00	100.0	8.434E-01	2.864E-01	4.233E-02
							· ·

Analyst

BKG FILENAME:

Reviewer

7/12/07

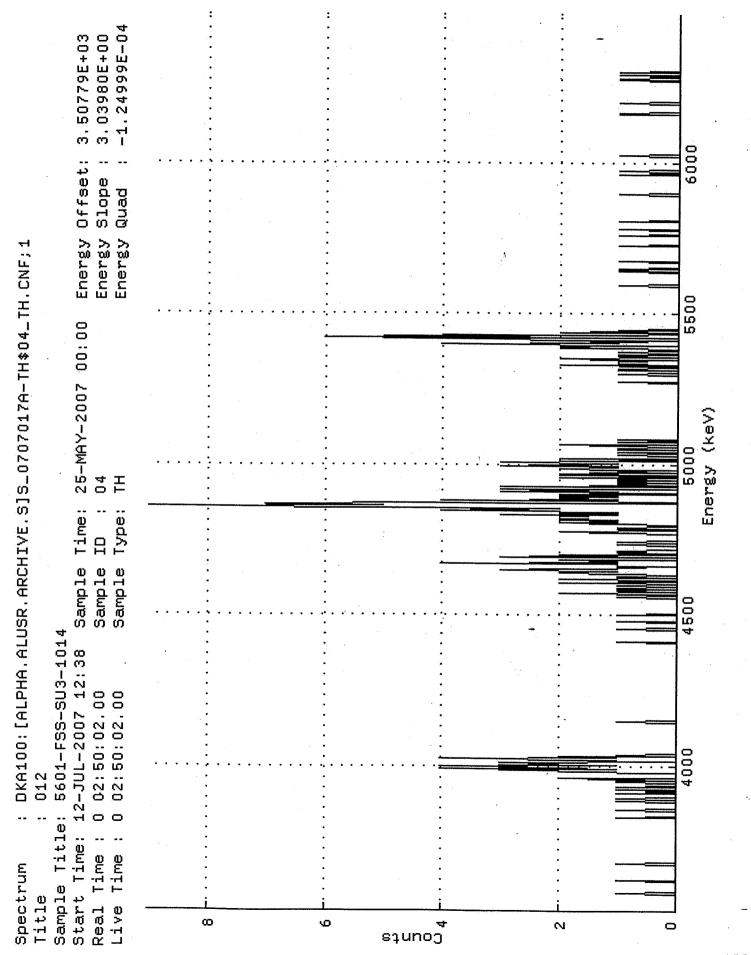
Date

B 012 6JUL07

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Date

60007.



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Gross Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:50.70

Detector ID: 12 Acquisition Start: 12-JUL-2007 12:38:20.01

Live Time: 0 02:50:02.00 Real Time: 0 02:50:02.00

Batch Id: 0707017A-TH Sample Id: 04

Sample Type: TH

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2 3 4	0 0 0	3985.07 4637.24 4892.65 5388.72 5864.24	54 51 145 54 8	0 0 0	50.16 14.38 30.87	158.04 377.41 464.45 635.37 801.62	306 408 553	102 129 105	5.29E-03 5.00E-03 1.42E-02 5.29E-03 7.84E-04	14.0 8.3 13.6	·

Background Counts Within Peak Regions Generated: 12-JUL-2007 15:46:52.52

Acquisition Start: 6-JUL-2007 15:28:34.01

Live Time: 0 16:40:07.00 Real Time: 0 16:40:07.00

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2 3 4	0 0	3952.67 4579.07 4917.80 5302.76 5872.78	0 3 2 6 5	01 02 02	53.02 78.50 32.59	146.50 356.50 472.00 605.00 805.50	306 408 553	102 129 105	0.00E+00 5.00E-05 3.33E-05 1.00E-04 8.33E-05	57.7 70.7 40.8	

Net Sample Counts Within Peak Regions Generated: 12-JUL-2007 15:46:53.43

Pk	It,	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	3985.07*	54	0	41.51	158.04	97	100	5.29E-03	13.6 -	
2	0	4637.24*	50	0	50.16	377.41			4.95E-03		
. 3	0	4892.65*	145	0	14.38	464.45			1.42E-02		•
4	0	5388.72*	53	0	30.87	635.37			5.19E-03		
5	0	5864.24*	7	03	19.18	801.62			7.01E-04		

Flag: "\*" = Peak area was modified by background subtraction

# VMS Nuclide Identification Report V3.0 Generated 12-JUL-2007 15:46:54

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : 5601-FSS-SU3-1014

Sample date : 25-MAY-2007 00:00:00 Acquisition date : 12-JUL-2007 12:38:20

Sample ID : 04 Sample quantity : 1.0333 gram

Sample type : TH Sample geometry :

Detector name : 012 Detector geometry:

Energy tolerance: 100.00 keV Half life ratio: 8.00 Errors propagated: Yes Systematic Error: 3.00 %

Abundance limit : 75.00

# Post-NID Peak Search Report

It	Energy	Area	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides	Activity pCi/gram
0 0 0 0	3985.07* 4637.24* 4892.65* 5388.72* 5864.24*	50 145 53		158.04 377.41 464.45 635.37 801.62	306 408 553	102 129 105	27.2 28.3 16.7 27.8 79.8		TH-232 TH-230 TH229 TH-228 TH-227	0.650 0.609 1.75 0.670 8.869E-02

Detector	Parameter	Flag	Filename
1	ALL	Passed	D 001 NONE
<b>2</b> .	ALL	Passed	D 002 NONE
3	ALL	Passed	D_003_NONE
4	OFFLINE		D_003_NOME
5	OFFLINE		
6	ALL	Passed	D_006 NONE
7	OFFLINE	-	D_000_NONE
8	ALL	Passed	D 008 NONE
	ALL	Passed	D 009 NONE
10	ALL	Passed	D 010 NONE
11	ALL	Passed	D 011 NONE
12	ALL	Passed	D 012 NONE
13	ALL	Passed	D 013 NONE
14	ALL	Passed	D_013_NONE
15	OFFLINE		D_014_NOME
16	ALL	Passed	D_016_NONE
17	OFFLINE		D_010_NONE
18	ALL	Passed	D 018 NONE
19	ALL	Passed	D 019 NONE
20	OFFLINE,		2_017_NOME
21	OFFLINE 1		
22	OFFLINE		
23	ALL	Passed	D_023 NONE
24	OFFLINE		
25	ALL	Passed	D 025 NONE
26	OFFLINE		
27	OFFLINE		•
28	ALL	Passed	D 028 NONE
29	ALL	Passed	D 029 NONE
30	ALL	Passed	D 030 NONE
31	ALL	Passed	D 031 NONE
32	OFFLINE	•	
33	ALL	Passed	D 033 NONE
34	ALL	Passed	D_034_NONE
35	OFFLINE	•	<del>-</del>
36 37	OFFLINE	· ·	•
38	ALL	Passed	D_037_NONE
39	ALL	Passed	D_038_NONE
40	OFFLINE		
41	OFFLINE		•
42	OFFLINE ALL		
43		Passed	D_042_NONE
44	OFFLINE OFFLINE	ю.	
	ALL	Do 3	
	ALL	Passed	D_045_NONE
2	ALL	Passed	D_046_NONE
	ALL	Passed	D_047_NONE
<del></del>	قالبده	Passed	D_048_NONE

APPROVAL DATE:

7.12.07

APPROVAL TIME:

APPROVED BY

PROCEDURE #

# SECTION IX ANALYTICAL DATA (RADIUM-226)

Eberline Services Oak Ridge Laboratory Analysis Sheet

Printed: 7/10/2007 3:21 PM Page 1 of 3

07-07017 Ra226 Run 1

and the second s						The second secon	
Work Order	07-07017	Internal Fraction	Sample Desc	Client ID	Login	Sample Date	Sample Allquot
Analysis Code	Ra226	01	SOT	SOT		00:00 20/50/20	1.0000E+00
Run	1	02	MBL	BLANK		00:00 20/90/20	1.0000E+00
Date Received	7/5/2007	03	DUP	5601-FSS-SU3-1014	49	05/25/07 09:45	1.1637E+00
Lab Deadline	7/26/2007	40	8	5601-FSS-SU3-1014	49	05/25/07 09:45	1.2095E+00
Client	Environmental Chemical Corporation						
Project	Li Tungsten						
Report Level	4					•	
Activity Units	pCi					ą.	
Aliquot Units	D						
Matrix	SO		:				
Method	EPA 903.0 Modified						
Instrument Type	Alpha Spectroscopy						
Radiometric Tracer	Ba-133					-	
Radiometric Sol#	Ba-6a				Ą		
Tracer Act (dpm/g)	1481.242	:		-			
Carrier	-		:				
Carrier Conc (mg/ml)		-					
						:	:

\* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. \*\* Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

Printed: 7/10/2007 3:21 PM Page 2 of 3

07-07017 Ra226 Run 1

Eberline Services Oak Ridge Laboratory Analysis Sheet

01 LCS 02 MBL 03 DUP 04 DO	0.7056 0.6986 0.7008					Commence of the second	(A)	vet (g)		% Kec	•	**
		1045.2	428.3	90.97		0.0242	0.0307	0.0065		90.97	2.34	1.00
		1034.8	435.3	93.39		0.0239	0.0309	0.0070	-	93.39	2.50	1.00
		1038.1	8.395.3	84.54		0.0242	0.0296	0.0054		84.54	1.91	1.00
	0.6992	1035.7	410.0	87.88	-	0.0241	0.0298	0.0057		87.88	2.04	1.00
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\* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. \*\* Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

Eberline Services Oak Ridge Laboratory Analysis Sheet

07-07017 Ra226 Run 1

Printed: 7/10/2007 3:21 PM Page 3 of 3

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Sep 11 By														•			
Sep t1 Date/Time																	
Sep t0 By										*		1			-		
Sep t0 Date/Time																	
Prep By	JBARNARD	JBARNARD	JBARNARD	JBARNARD												-	
Prep Date	07/06/07 06:46	07/06/07 06:46	07/06/07 06:46	07/06/07 06:46		Total Control					-						
Rough Prep By				JPACHELLA		-			-		-		-				
Rough Prep Date				07/06/07 08:29	•												
Sample Desc	rcs	MBL	DUP	DO													
Internal Fraction	2	05	03	40	-												

, \* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. \*\* Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

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# Preliminary Data Report & Analytical Calculations Work Order: 07-07017-Ra226-1

Eberline Services Oak Ridge Laboratory

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LCS %R	104.15											-							
LCS	1.01E+01												5						
MDA	2.16E-01	2.87E-01	2.41E-01	2.21E-01		-						<del></del>							
Error Estimate	1.39E+00	1.01E-01	2.92E-01	3.31E-01		• 40 000 000 000 000													
Results Erro	1.06E+01	5.14E-02	7.71E-01 2	1.01E+00 3														-	
	-	-	7.7	+		-			-		_					-		· · · · · · · · · · · · · · · · · · ·	
Activity Units	bCI/g	pCI/g	pCI/g	bCI/g						-									
Client Identification	SOT	BLANK	5601-FSS-SU3-1014	5601-FSS-SU3-1014	-			-											
			5601-F	5601-F					-					•			-		
Sample Desc	rcs	MBL	DUP	8											-				
Nuclide	RA-226	RA-226	RA-226	RA-226											:				
Fraction	5	02	03	04															

				<del></del>
<b>9</b> 00	L	Ra226	71070-70	Environmental Chemical Corporation
	uny	Analysis Code	Eberline Services Work Order	Client

Printed: 7/11/2007 10:56 AM Page 2 of 3

Preliminary Data Report & Analytical Calculations Work Order: 07-07017-Ra226-1

Eberline Services Oak Ridge Laboratory

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Radiometric % Rec	90.97	93.39	84.54	84.78																		
adlon % R																						
흥호	1.00E+00	1.00E+00	1.16E+00	1.21E+00						,								T				
Sample Aliquot	1.00	1.00	1.16	1.21																	ľ	
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	00:0	8	93.4	93:4																		
Sample Date	07/08/07 00	07/05/07 00:00	05/25/07 09	05/25/07 09:45												-						
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Sample Desc	SOT	MBL	DOP	8															+			
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Nuclide	RA-226	RA-226	RA-226	RA-226	·												-					
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Fraction	2	02	03	04					.													j
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Preliminary Data Report & Analytical Calculations Work Order: 07-07017-Ra226-1

15	20.6	20.1	8	20.1											
Bkg CPM	4.00 E-03	8.00 E-03	1.20 E-02	1.00 E-02											
Counts	170.08 7.48 E+02	170.02 3.64 E+00	170.02 5.72 E+01	170.05 8.19 E+01											
Count	170.08	170.02	170.02	170.05											
Carrier	-	2	m	9											
Detect	A_Spec	A_Spec	A_Spec	A_Spec											
Halfilfe (days)					•										
Counting Date/Time	07/10/07 15:27	07/10/07 15:28	07/10/07 15:29	07/10/07 15:30			-		•	-		•			
Sample Desc	SOT	MBL	DUP	8									_		
Nuclide	RA-226	RA-226	RA-226	RA-226											
Lab Fraction	2	02	03	94											

**71070-70** 

Eberline Services Work Order

Ra226

Analysis Code

Run

Environmental Chemical Corporation

Client

Count Room Report Client: Environmental Chemical Co

Printed: 7/10/2007 3:21 PM / Page 1 of 1

07-07017-Ra226-1 (pCi/g) in SO Tracer ID: Ba-6a

Internal Fraction	Sample Desc	Client ID	Sample Date	Sample Aliquot	Tracer Allquot (g)	Tracer ACT (dpm)	Radiometric Tracer (pCl)	Radiometric % Rec	SAF 1"	SAF 2*
07	SOT	SOT	07/05/07 00:00	1.0000	0.7056	1045.1644	428.3000	90.97	2.34	1.00
05	MBL	BLANK	07/05/07 00:00	1.0000	0.6986	1034.7957	435.3000	93.39	2.50	1.00
03	DUP	5601-FSS-SU3-1014	05/25/07 09:45	1.1637	0.7008	1038.0544	395.3000	84.54	1.91	1.00
40	8	5601-FSS-SU3-1014	05/25/07 09:45	1.2095	0.6992	1035.6844	410.0000	87.88	2.04	1.00
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Spike and Tracer Worksheet

Eberline Services Oak Ridge Laboratory

Page 1 of 1 Printed: 7/6/2007 6:46 AM

	Internal Work Order	ork Order		Run	Analysi	Analysis Code	0	Date		Technician	cian		Technicia	Technician Initials	Witness Initials	Initials
	07-07017	7117		τ	Ra;	Ra226	7/6/20	7/6/2007 6:42		JBARNARD	IARD		O	AR.		
	S SOT	LCS & Matrix Spikes	ikes		S27	. WS	CSD	MSD	ეე	CS	MS	S	TCSD	SD	OSM	0
Isotope	# JoS	Activity dpm/g	Solution Date	Approx Addition	Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Known	Error Estimate	Added pCi	Error Estimate	Known pCI	Error Estimate	. Added pCl	Error Estimate
Ra-226	Ra-5b	44.182	7/6/2007	0.500	0:2030				10.13	0.466	0.00	0.000	00:00	0.000	00.00	0.000
																,

nter Tapes	rcs					8. 5898 9. 5898 9. 5888	6.466K	これの はない ないない ないない はいない はいない はいない はいない はいない	•	Matrix Spike					•	
Balance Printer Tapes	Tracer					-	2,7868 q					2				
	Approx Addition	0.6800	0.6800	0.6800	0.6800											
	Volume Used (g)	0.7056	0.6986	0.7008	0.6992											
	Solution Date	7/6/2007	7/6/2007	7/6/2007	7/6/2007						•					
Tracers	Activity dpm/g	1481.242	1481.242	1481.242	1481.242								-			
	So/#	Ba-6a	Ва-ба	Ва-ба	Ba-6a											
	Isotope	Ba-133	Ba-133	Ba-133	Ba-133											
	fraction	01	02	03	40											

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Page 1 of 1

Eberline Services - Oak Ridge Version 2.0 8/1999

H-3 Solids Only Water Added (ml) Net Equiv **MS Aliquot Data JBARNARD** Aliquot 1.0000E+00 1.0000E+00 1.0000E+00 1.0000E+00 1.1637E+00 1.1637E+00 1.2095E+00 1.2095E+00 Aliquot Data Aliquot Ratio 7/26/2007 Lab Deadline Dilution Data Dil Factor grams Rpt Units No of Dils **Analysis Code** Muffle Data Ra226 Ratio Post/Pre Sample Type LCS MBL DUP Run **Environmental Chemical Corporation** 5601-FSS-SU3-1014 5601-FSS-SU3-1014 07-07017 BLANK Client ID Lab Fraction 2 2 2 2

Date: 4/4/07

明の日本の大田本

1.1637 g 1.2095 g

Comments

142

Technician:

**Aliquot Worksheet** 

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# **Gravimetric Worksheet**

Eberline Services - Oak Ridge Version 1.0 9/1999

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
07-07017	7	Ra226			DJOHNSON

Technician:

Rough Sample Preparation Log Book

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Eberline Services - Oak Ridge Prep Logbook Version 2.0 8/1999

	Work Order	Lab Deadline	Date Received in Prep	d in Prep	Date Sealed	Date Re	Date Returned		Technician	
	07-07017	7/26/2007	7/5/200	200	7/6/2007	3/2/12	7/7/2007	<b>5</b>	JPACHELLA	4
Eberline	Eberline Environmental Chemical Corporation	Tare (g)	Gross (g)	(a)	let (g)	Per	Percent	Gar	Gamma	Special
Fraction	Client ID	Pan Wt	Wet Wt.	Dry Wt.		Liquid	S	Dry Wt.	LEPS Wt.	Info
94	5601-FSS-SU3-1014	28.4000	1894.6500	1555.1600	1866,2500 1526,7600	18:19%	81.81%	And the second s		
			-							
			-							
	4									
			-							
· · · · · · · · · · · · · · · · · · ·	Comments	-			·				-	>
	Special Codes	H: Hot. O:	Organic Ha	zard. P. P	H: Hot. O: Organic Hazard. P: PCB Hazard. R: Rush. T: Other (see comments)	Other (se	e comments	(5)		-

Technician: Of bellette

Date: Analysis: Rough Prep Logbook

Analysis: Ra226 Page No. 5721

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### ALPHA SPECTROMETRY REPORT 11-JUL-2007 10:33:46

\*

Spectral File: ND\_AMS ARCHIVE\_C:C\_0707017A-RA\$01 RA.CNF \* SAMPLE ID: 01 0707017A-RA BATCH ID: 1.000E+00 gram ALIQUOT: SAMPLE DATE: 5-JUL-2007 00:00 001 DETECTOR NUMBER: SPIKE SAMPLE TITLE: 20.64% AVERAGE EFFICIENCY: 10-JUL-2007 15:27 ACO DATE: 90.97% RECOVERY: 10205. ELAPSED LIVE TIME: TRACER FWHM (kev): 0.00 NONE TRACER ID: MANUAL ROI TYPE: LAMBDA VALUE: 0. 4.65 CONFIDENCE FACTOR: TRACER DPM AT SAMPLE DATE: 0.000 2.71 LLD CONSTANT:

EFF CAL DATE:

SAF:

BKG ELAPSED TIME:

SOIL

6-JUL-2007 07:08

B 001 6JUL07

### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram	
PO-218	6003.0	3497.07	3.57	100.0	4.935E+01	4.279E+00	3.797E-01	
RN-222	5490.0	3267.79	1.19	99.9	4.614E+01	4.050E+00	2.572E-01	
RA-226	4785.0	748.12	0.68	100.0	1.055E+01	1.391E+00	2.161E-01	
								* 4

SAMPLE MATRIX:

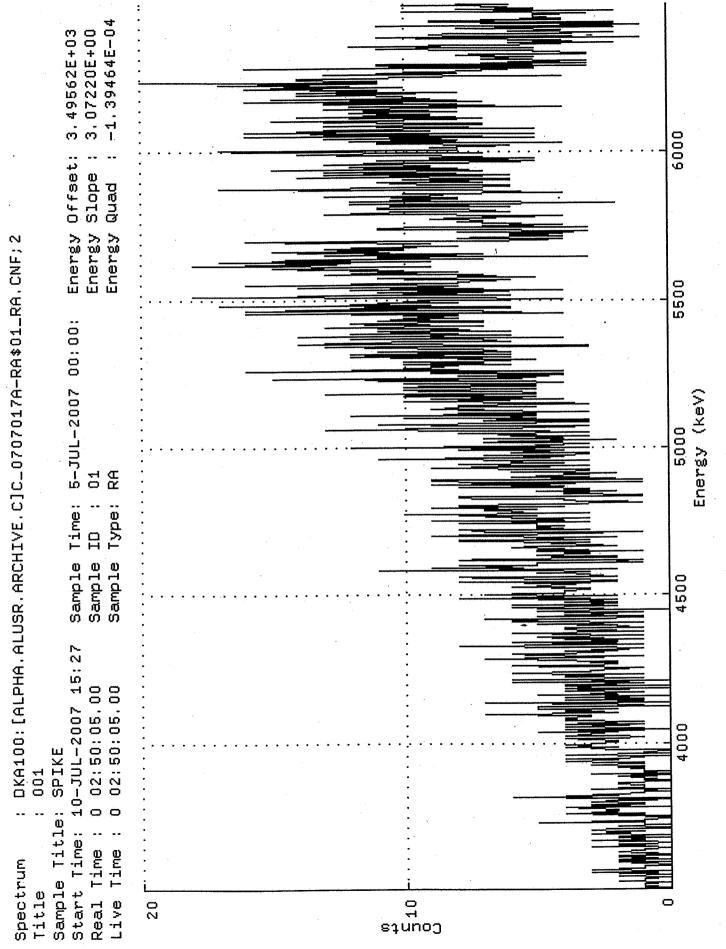
BKG FILENAME:

ENERGY CAL DATE:

6-JUL-2007 07:08

60002.

2.34



Channel											·			
1: 15: 29: 43: 57: 71: 85: 99: 113: 127: 141: 155: 169: 183: 197: 211: 225: 239: 267: 281: 295: 307: 407	1020500011023023134303433413447848365499736387645316274972154949568761151301213354850	1020 5000212423110447203221222385385852164560534693276983170832260120116123078658250	121120111010222144244332553551533373585682387381190773986911988061571115	1021013013221134313255126351540236536765511064011686853551111112944422211931135	00012124104324414321145843155533338627536891311020814114409741192274440778613	11200120112243420653211354242554554574249592368668078576077378899111765877	132105262044312443534506451495648354435006868907084110677883106854881762920	1103313221233450137856524386786744685758550868997711104888669713091342576823	1011214421142355234365533575637852573188586179821165308713606822131111657592	0322110201135452621117678112249589633653405867300891139481199135851397124584298	2101203112032403013333252223149164112578994072788419033909012181671261121176645	11203011014204216156316429447541136583765987476012587688681779771869332575	1101223011024324446241344855738473547395546941149751447159078573118508735447	111300111312137416424524463386849445378109811127848311511712491596511091541155657

Gross Sample Counts Within Peak Regions Generated: 11-JUL-2007 10:33:39.41

Detector ID: 1 Acquisition Start: 10-JUL-2007 15:27:15.01

Live Time: 0 02:50:05.00 Real Time: 0 02:50:05.00

Batch Id: 0707017A-RA Sample Id: 01

Sample Type: RA

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2	0	4748.23 5299.02 5809.12	320 1397 1496	049	5.34	415.56 603.54 780.71	508	176	3.14E-02 1.37E-01 1.47E-01	2.7	Į.

Background Counts Within Peak Regions Generated: 11-JUL-2007 10:33:44.69

Acquisition Start: 6-JUL-2007 15:27:59.01

Live Time: 0 16:40:02.00 Real Time: 0 16:40:02.00

Pk It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1 0 2 0 3	4746.29 5276.30 5817.65	4 7 21		415.00 595.50 782.50	508	176	6.67E-05 1.17E-04 3.50E-04	37.8	

Net Sample Counts Within Peak Regions Generated: 11-JUL-2007 10:33:45.03

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2	0	4748.23* 5299.02* 5809.12*	748 3268 3497	04	95.34	415.56 603.54 780.71	508	176	7.33E-02 3.20E-01 3.43E-01	2.7	

Flag: "\*" = Peak area was modified by background subtraction

### VMS Nuclide Identification Report V3.0 Generated 11-JUL-2007 10:33:46

: MCA0: [AMSCOUNT] 0000B288\$1 Configuration

: ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3 Analyses by

Sample title : SPIKE

Acquisition date : 10-JUL-2007 15:27:15 : 5-JUL-2007 00:00:00 Sample date

Sample quantity : 1.0000 gram : 01 Sample ID

Sample geometry : RA Sample type Detector geometry: : 001 Detector name

Elapsed real time: 0 02:50:05.00 0.0% Elapsed live time: 0 02:50:05.00

Half life ratio : Energy tolerance: 150.00 keV Systematic Error: 3.00 % Errors propagated: Yes

Efficiencies at : Peak Energy Efficiency type : Average value Abundance limit : 75.00

### Post-NID Peak Search Report

It	Energy	Area FWHM Channe	l Left Pw	%Err Fit	Nuclides	Activity pCi/gram
0 0 0	4748.23* 5299.02* 5809.12*	748181.00 415.5 3268495.34 603.5 3497 0.00 780.7	4 508 176	5.4	RA-226 RN-222 PO-218	9.60 42.0 44.9

### ALPHA SPECTROMETRY REPORT 10-JUL-2007 19:58:12

\*\*\*\*\*\*\*\*\*\*\*\*\* Spectral File: ND\_AMS\_ARCHIVE\_R:R\_0707017A-RA\$02 RA.CNF 

		*		
BATCH ID:	0707017A-RA	*	SAMPLE ID:	02
	-2007 00:00	*	ALIQUOT: 1.000E+00	) gram
SAMPLE TITLE:	BLANK	*	DETECTOR NUMBER:	002
	-2007 15:28	*	AVERAGE EFFICIENCY:	20.10%
ELAPSED LIVE TIME:	10201.	*	RECOVERY:	93.39%
TRACER ID:	NONE	*	TRACER FWHM (kev):	0.00
LAMBDA VALUE:	0.	*	ROI TYPE:	STANDARD
TRACER DPM AT SAMPLE DA	TE: 0.000	*	CONFIDENCE FACTOR:	4.65
SAMPLE MATRIX:	SOIL	*	LLD CONSTANT:	2.71
	-2007 07:08	*	EFF CAL DATE: 6-JUL-200	7 07:08
	3 002 6JUL07	*	BKG ELAPSED TIME:	60007.
		*	SAF:	2.50

### NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
PO-218	6003.0	6.31	1.19	100.0	8.908E-02	1.231E-01	2.747E-01
RN-222	5490.0	11.31	1.19	99.9	1.598E-01	1.588E-01	2.748E-01
RA-226	4785.0	3.64	1.36	100.0	5.138E-02	1.008E-01	2.870E-01

Analyst

-1.38508E-04 3,50621E+03 3,05374E+00 6000 Energy Offset: Energy Slope : Quad Energy DKA100:[ALPHA.ALUSR.ARCHIVE.R]R\_0707017A-RA\$02\_RA.CNF;1 5500 10-JUL-2007 00:00 02 RA Energy (keV) 5000 Time: Sample Type: Sample ID : Sample 4500 10-JUL-2007 15:28 0 02:50:01.00 0 02:50:01.00 4000 002 BLANK Sample Title: Live Time : Start Time: Real Time : Spectrum Title տ co.... էa

Channel														
triannet	10201	10201	0	0	0	0	0	0	.0	0	0	0	0	0
15:	0	0	0	0	0	0	0	0	0	0	0	0	0	0 0
29: 43:	0 0	0	0	.0 .0	0	0	0	0	0	0	Ö	Ö	Ö	Ö
57:	0	0	0	Ó	0	0	0	0	0	0	0	0.	0	0
71: 85:	0	0	0	0	0	.0 0	0	0	0	,0 0	.0	0	0	0
99:	0	0	0	0	0	0	0	0	0	0	0	0	0	0
113: 127:	0 0	0	0	0	0	0	0	0 0	0	0	0	0 0	0 0	0
141:	Ö	0	.0	0	0	0	0	0	Ó	0	0	0	0	0
155: 169:	0 0	0 0	0	0 0	0	0	0	0	0 0	0 0	0	0	0	0 0
183:	Ö	0	0	0	0	Ō	0	0	0	0	0	0	0	0
197:	0 0	0	0	0 0	0 0	0	0	0	0 0	0 0	0	0 1	0	0 0
211: 225:	0	0	0	0	.0	0	.0	0	O.	0	0	0	0	1
239: 253:	0	0	. 0 0	0 0	0	0 0	0 0	0	0'	0	0 0	0	0	0 0
267:	0	0	0	0	0	0	0	0	0	0	0	0	0	0
281: 295:	0 0	0	0	0 0	0 0	0	0 0	0	0	0	0	0 0	0 0	0
309:	0	0	0	O	0	0	0	0	0	0	0	0	0	0
323:	0	0	0 0	0	0	0	0	0	0. 0	0	0 0	0	0	0
337: 351:	Ö	0	0	0	0	0	0	0	0	-0	Ö	0	0	0
365: 379:	O` O	0	0	0 0	0	0 0	0	0	0 0	0	0	0	0	0
379: 393:	0	0	0	0	0	0	0	0	0	1	0	0	0	0
407: 421:	0	0 0	0	0	0 0	0	0	0	0	<u>0</u> 0	0	0 0	0	0
435:	0	0	0	0	0	0	0	0	Ō	0	0	0	0	0
449: 463:	0	0	0	0 0	0	0	0	0 0	0 0	0	1 0	0	0	0
477:	Ö	0	Ó	0	0	0	0	0	0	0	0	0	0	0
491: 505:	0	0	0 0	· 0	0	0 0	:0 0	0 0	0	0 0	0 °	0	0	0
519:	0	0	1	0	0	0	0	0	0	0	0	0	0	0
533: 547:	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0
561:	0	0	0	:0	Ō	0	0	0	0	0	0	.0	0	0
575: 589:	0 1	0	0	0	0 0.	0	0	0	0	0	0	,0 0	0	0
603:	0	0	0	0	0	0	0	0	0	1	0	0	. 0	1 0
617: 631:	0 0	0 1	0	0 0	0	0	0	0	0	0 0	0 0	.0 0	0	0
	0	0	0	Õ	0	0 1	Ò	0	0	0	0	0	0	0
659: 673:	0	0	0 0	0	0 0	0 0	0	0	0 0	- 0 - 0	0	Q.	. 0	0
687:	0	0	0	0	0	.0	0	0	0	0	0	0 0	. 0	0
701: 715:	0	0 0	0	0	0	0	0 0	0	0	0	0	0	. 0	0
729:	0	0	0.	0	0	0	0	0	1 0	0	0 0	1 0	0	0 0
743: 757:	0	0	0 0	0	0.0	0	0	. 0	0	0	0 .	0	0	0
771:	0	0	0.	Ö	0	0	0 0	1 0	0	0 -	0	.0 0	0	0
785: 799:	0 0	:0 :0 :	0 0	0	0 0	. 0	0	0	0	0	0	.0	0	0
813:	0	0 0	0	0	0 0	0 0	0	0	0 0	0	0	0	0	0
827: 841:	0 0	0	0 0	0	0	0	0	0	0	0	0	0	0	0
855:	0	0	0	0	0 0	0 1	0	0	0	0 0	0	1 0	0 0	0 0
883:	0	0	0 0	0 0	0	0	.0	0	0	0	0	0	0	0
897:	0	0	0 0	0	0	0	0	0 0	0 0	0	0	0	0 0	0
925:	0	1	0	0	0	0	0	0	0	0	0	0	0	Ŏ
939:	0	0 0	0	0 0	1 0	0 0	0	0	0 0	0 0	0	0	0 0	0
967:	0	.0	0	0	0	.0	Ó	Ò	0	0	0	0	0	0 0 0 0 0 0
981:	0	0 0	0 0	0 0	0	0	0	0	0 0	0	1 0	0 0	0 0	0
645: 659: 673: 687: 701: 715: 729: 743: 757: 771: 785: 799: 813: 827: 841: 855: 869: 883: 897: 911: 925: 939: 953: 967: 981: 995:	0	0	Ö,	0	0	0	1	Ö	Ö	ő	ő	ŏ	0 0	ō
1023:	0	0											,	

Gross Sample Counts Within Peak Regions Generated: 10-JUL-2007 19:57:31.15

Detector ID: 2 Acquisition Start: 10-JUL-2007 15:28:08.01

Live Time: 0 02:50:01.00 Real Time: 0 02:50:01.00

Batch Id: 0707017A-RA Sample Id: 02

Sample Type: RA

Pk It	Energy	Area	Bkgnd F	WHM Chan	nel Left	Pw	Cts/Sec	%Err	Fit
2 0	4748.19 5271.26 5723.35	2 5 3	0342	.40 414 .02 594 .26 751	.00 507	177	1.96E-04 4.90E-04 2.94E-04	44.7	N. A.

Background Counts Within Peak Regions Generated: 10-JUL-2007 19:58:09.00

Acquisition Start: 6-JUL-2007 15:28:03.01

Live Time: 0 16:40:07.00 Real Time: 0 16:40:07.00

P)	k .	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
_			4604.80	8			366.00			1.33E-04		
	_	-	5273.98 5814.82	7 7			595.00 784.00			1.17E-04 1.17E-04		

Net Sample Counts Within Peak Regions Generated: 10-JUL-2007 19:58:09.40

Pk	It	Energy	Area	Bkgnd FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2	0	4748.19* 5271.26* 5723.35*	4 11 6	0342.02	414.50 594.00 751.67	507	177	3.57E-04 1.11E-03 6.19E-04	49.6	

Flag: "\*" = Peak area was modified by background subtraction

### VMS Nuclide Identification Report V3.0 Generated 10-JUL-2007 19:58:10

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : BLANK

Sample date : 10-JUL-2007 00:00:00 Acquisition date : 10-JUL-2007 15:28:08

Sample ID : 02 Sample quantity : 1.0000 gram

Sample type : RA Sample geometry :

Detector name : 002 Detector geometry:

Energy tolerance: 100.00 keV Half life ratio: 8.00
Errors propagated: Yes Systematic Error: 3.00 %
Efficiency type: Average value Efficiencies at: Peak Energy

Abundance limit : 75.00

### Post-NID Peak Search Report

It	Energy	Area FWHM	Channel	Left	Pw %Err	Fit	Nuclides	Activity pCi/gram
0	4748.19* 5271.26* 5723.35*	4 79.40 11342.02 6128.26	414.50 594.00 751.67	507	157196.0 177 99.2 163138.0		RA-226 RN-222 PO-218	4.798E-02 0.149 8.319E-02

### ALPHA SPECTROMETRY REPORT 10-JUL-2007 20:06:30

\* Spectral File: ND AMS ARCHIVE S:S 0707017A-RA\$03 RA.CNF BATCH ID: 0707017A-RA SAMPLE ID: 03 SAMPLE DATE: 25-MAY-2007 00:00 ALIQUOT: 1.164E+00 aram SAMPLE TITLE: 5601-FSS-SU3-1014 DETECTOR NUMBER: 003 ACQ DATE: 10-JUL-2007 15:29 AVERAGE EFFICIENCY: 19.98% ELAPSED LIVE TIME: 10201. RECOVERY: 84.54% TRACER ID: NONE TRACER FWHM (kev): 0.00 LAMBDA VALUE: 0. ROI TYPE: STANDARD TRACER DPM AT SAMPLE DATE: 0.000 CONFIDENCE FACTOR: 4.65 SAMPLE MATRIX: SOIL LLD CONSTANT: 2.71 ENERGY CAL DATE: 6-JUL-2007 07:08 EFF CAL DATE: 6-JUL-2007 07:08 BKG FILENAME: B 003 6JUL07 BKG ELAPSED TIME: 60004. SAF: 1.91 NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	NET AREA	BKG	%ABN	ACTIVITY pCi/ gram	TPU/ERROR 2-SIGMA	MDC pCi/ gram
PO-218	6003.0	66.89	1.87	100.0	9.017E-01	3.156E-01	2.335E-01
RN-222	5490.0	83.23	2.72	99.9	1.123E+00	3.548E-01	2.674E-01
RA-226	4785.0	57.17	2.04	100.0	7.705E-01	2.920E-01	2.407E-01
****	****	****	****	*****	*****	*****	******

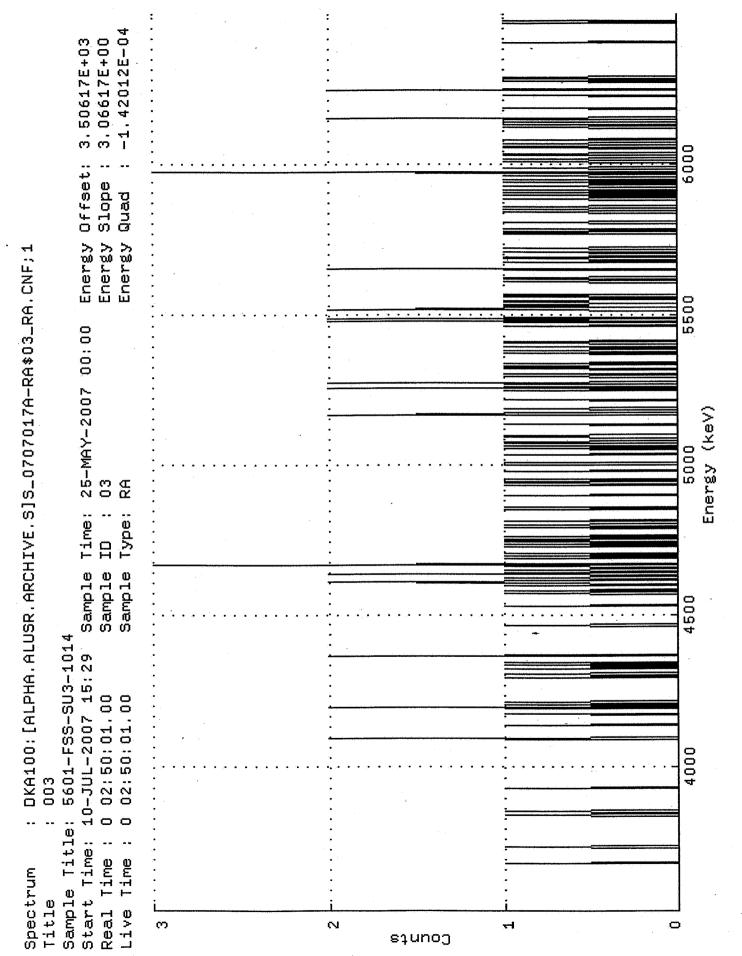
Analyst

Date

Reviewer

7/11/07

Date



Channel											-			
1: 15: 29: 43: 57: 71: 85: 99: 113: 127: 141: 155: 169: 183: 211: 225: 239: 267: 281: 295: 309: 323: 367: 449: 449: 449: 449: 470: 519	10201 000000000000000000000000000000000	10201	000001000000000000000000000000000000000	000000000000000000120001100100000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000101000000030000000000000	000000000000000000000000000000000000000	0000001000000000001001000000100001000201011100101210100003000000200000	000000000001100010000001000100001000010000	000000010000000100000000000000000000000	00010000000000000000000000000000000111012011000101000000	000000010000000000000000000000000000000

Gross Sample Counts Within Peak Regions Generated: 10-JUL-2007 19:58:20.40

Detector ID: 3 Acquisition Start: 10-JUL-2007 15:29:20.01

Live Time: 0 02:50:01.00 Real Time: 0 02:50:01.00

Batch Id: 0707017A-RA Sample Id: 03

Sample Type: RA

Pk It	Energy	Area	Bkgnd FW	HM Channel	Left	Pw	Cts/Sec	%Err	Fit
2 0	4671.70 5308.13 5834.13	31 45 36	0375.	32 387.06 51 604.62 71 788.00	506	176	3.04E-03 4.41E-03 3.53E-03	14.9	

Background Counts Within Peak Regions Generated: 10-JUL-2007 20:06:27.80

Acquisition Start: 6-JUL-2007 15:28:06.01

Live Time: 0 16:40:04.00 Real Time: 0 16:40:04.00

Pk It Energy Area Bkgnd FWHM Channel Left Pw Cts/Sec %Err  1 0 4604.49 12 0 0.00 365.00 287 157 2.00E-04 28.9	Fit											
	*	Err I	Cts/Sec	Pw	Left	Channel	FWHM	Bkgnd	Area	Energy	It	Pk
2 0 5273.69 16 0 3.08 593.50 506 176 2.67E-04 25.0 3 0 5810.19 11 0311.46 781.00 700 163 1.83E-04 30.2		25.0	2.67E-04	176	506	593.50	3.08	0	16	5273.69	0	2

Net Sample Counts Within Peak Regions Generated: 10-JUL-2007 20:06:28.22

Pk I	t	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1 2 3	0	4671.70* 5308.13* 5834.13*	57 83 67	03	75.51	387.06 604.62 788.00	506	176	5.60E-03 8.16E-03 6.56E-03	15.4	

Flag: "\*" = Peak area was modified by background subtraction

### VMS Nuclide Identification Report V3.0 Generated 10-JUL-2007 20:06:29

: MCA0: [AMSCOUNT] 00021072\$1 Configuration

: ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3 Analyses by

: 5601-FSS-SU3-1014 Sample title

: 25-MAY-2007 00:00:00 Acquisition date : 10-JUL-2007 15:29:20 Sample date

Sample quantity : 1.1637 gram : 03 Sample ID

: RA Sample geometry Sample type Detector geometry: : 003 Detector name

Elapsed real time: 0 02:50:01.00 0.0% Elapsed live time: 0 02:50:01.00

Half life ratio : Energy tolerance: 100.00 keV Systematic Error : 3.00 % Errors propagated: Yes Efficiency type : Average value Abundance limit : 75.00 Efficiencies at : Peak Energy

### Post-NID Peak Search Report

It	Energy	Area FWHM	Channel	Left	Pw	%Err	Fit	Nuclides	Activity pCi/gram
0 0 0	4671.70* 5308.13* 5834.13*	57 61.32 83375.51 67345.71	604.62	506	176	37.3 30.8 34.3		RA-226 RN-222 PO-218	0.651 0.949 0.762

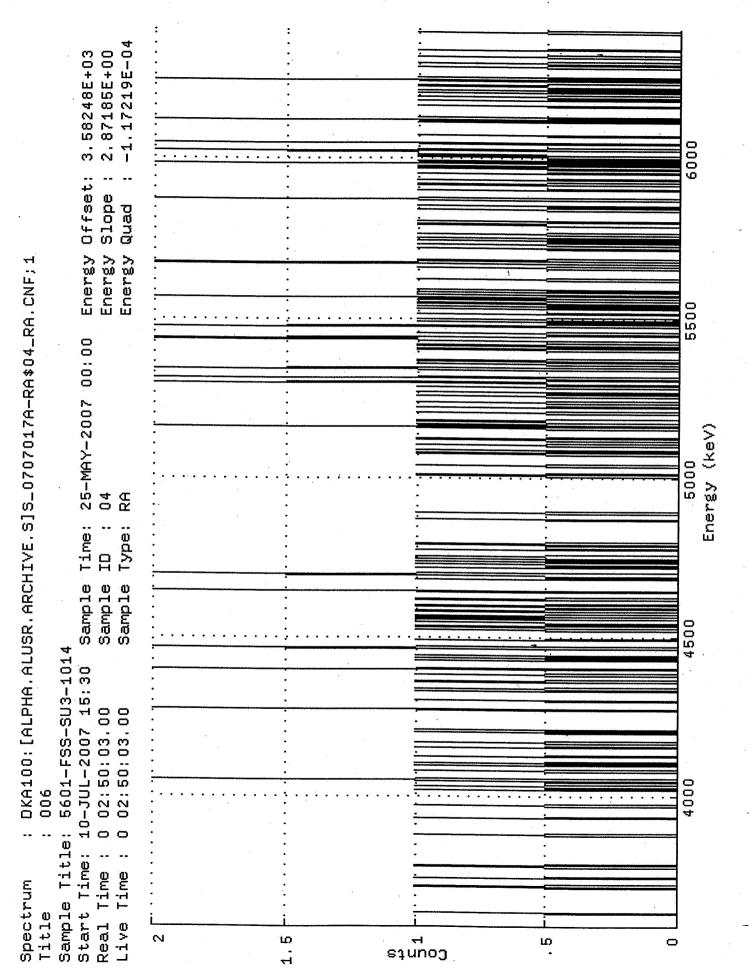
### ALPHA SPECTROMETRY REPORT 10-JUL-2007 20:06:58

\* Spectral File: ND AMS ARCHIVE S:S 0707017A-RA\$04 RA.CNF \* BATCH ID: 0707017A-RA SAMPLE ID: 04 SAMPLE DATE: 25-MAY-2007 00:00 ALIOUOT: 1.209E+00 gram SAMPLE TITLE: 5601-FSS-SU3-1014 \* DETECTOR NUMBER: 006 ACO DATE: 10-JUL-2007 15:30 AVERAGE EFFICIENCY: 20.15% ELAPSED LIVE TIME: 10203. RECOVERY: 87.88% TRACER ID: NONE TRACER FWHM (kev): 0.00 LAMBDA VALUE: 0. ROI TYPE: STANDARD TRACER DPM AT SAMPLE DATE: 0.000 CONFIDENCE FACTOR: 4.65 SAMPLE MATRIX: LLD CONSTANT: SOIL 2.71 ENERGY CAL DATE: 6-JUL-2007 07:08 EFF CAL DATE: 6-JUL-2007 07:08 BKG FILENAME: B 006 6JUL07 BKG ELAPSED TIME: 60000. SAF: 2.04 \* NUCLIDE ACTIVITY SUMMARY NUCLIDE ENERGY NET **BKG** %ABN ACTIVITY TPU/ERROR MDC AREA pCi/ gram 2-SIGMA pCi/ gram PO-218 6003.0 85.51 2.21 100.0 1.058E+00 3.395E-01 2.429E-01 RN-222 5490.0 106.42 99.9 1.70 1.318E+00 3.792E-01 2.216E-01 RA-226 4785.0 81.94 1.70 100.0 1.014E+00 3.310E-01 2.214E-01 \*

//

Date

Date



Channel															
1:	10203	10203	0	0	,0	,0	0	0	0	0	. 0	0	0		0
15: 29:	0 0	0	0	1 0	0	0	0	0	0	0 0	0 0	.0 0	0		0
43:	0	0	Ō	1	Ö	1	Ŏ	ŏ	ŏ	Ô	Ö	ŏ	0		0
57: 71:	1 1	0	0 0	0	0	0	0	0	0	0	0	0	1		0
85:	Ö	0	0	0	0	0	0	0	0 0	0 0	0 0	0	0		0
99:	0	0	0	0	0	1	Ō	0	0	0	ŏ	0	ő	•	Ö
113: 127:	.0 0	0	.0 .0	0	0	0	0	0	0	0	1	0	0		0
141:	ő	Ö	.0	0	Ü	Ö	0	0	0	. 0	1 0	0 0	0		0
155:	.0	0	0	1	0	0	0	0	1	0	2	0	ő		ó
169: 183:	0 0	.0 1	0	0	0	0	1	0 · 0	.0 1	0 0	. 0	0	1		0
197:	ŏ	ó	Ö	Ö	1	ŏ	0	0	Ó	1	0	0	0		0
211:	0	0	0	0	0	0	1	0	Ō	1	0	0	0		Õ
225: 239:	0 0	0	0 0	0	0 2	0	0 0	. 0	0	0 0	0 0	0	0		0
253:	1	ŏ	ŏ	ŏ	Õ	Ŏ	ŏ	ŏ	Ö	Ö	Ö	1	0		0
267:	0	0	0	0	0	0	0	1	1	0	Ó	0	0		0
281: 295:	0	1	<u>0</u> 0	0 1	0	0	0	2	· 1	0 0	0	0	0		0
309:	0	0	. 1	ż	ŏ	ŏ	ò	ŏ	Ó	0	Ö	0	1		0
323:	0	0	0	0	0.	0	0	0	0	1	0	0	1		0
337: 351:	1 0	0	0 1	0 1	1 0	1	1 0	0 1	1 0	0 1	1 0	1	0		0
365:	0	1	1	ó	Ŏ	ŏ	ŏ	ö	Ö	ò	2	Ö	0		Ö
379: 393:	0	0	0	0	0	0	. 0	0	0	0	1	0	0		0
407:	1 0	2	0 1	0 0	0	0 1	0 1	0 1	0 1	1 0	0	0	0 0		1
421:	0	1	0	0	0	0	1	0	. 1	Ŏ,	0	ŏ	Ö		Ö
435: 449:	0 0	0	0	0	0 .	. 0	0	0	0	0	0	0	0		0
463:	Ö	1	0	0	0	0 0	0	1. 0	. 0	0	0 0	0	0 0		0
477:	0	0	Ó	.0	0	0	0	0	Ó	0	ŏ	ŏ	ŏ		Ö
491: 505:	0	·0 1	0 0	0 1	0	0 0	0	0 0	0	0	0	0	.0		0
519:	Ö	Ó	Ö	Ó	0	0	0	0	0 0	0 0	0 0	0	0 1		1
533:	0	0	1	0	. 0	0	0	0	1	0	0	0	0		Ó
547: 561:	1 0	. 0 2	1 0	0	0 1	0	0 1	0 1	0 1	0	0	0 0	0		0
575:	ŏ	Õ	ő	i	ò	Ö	Ó	ó	Ů	1	0	0	.0		0
589:	1	1	0	0	0	0	0	0	1	0	0	0	1		0
603: 617:	.0 1	0 2	0	0	1	0 0	0	0	1 . 0 .	2	1 0	0	0		0
631:	0	0	0	1	.0	1	Ó	1	0	Ö	Ö	ō	ó		Ö
645: 659:	0	0 0	0	0	0	1	1	0	0	1	0	1	0.		0.
673:	0	Ö	ŏ	2 0	1 2	2	1 0	Ο σ	· 0	- 10 T	1 0	0	0		0
687:	. 0	0	0	0	0	1	0	0	0	0	Ŏ	1	ó		Ö
701: 715:	1 1	0 1	1 0	0 0	1	0	0	1 0	0	2 0	1 0	0	0		1
729:	0	0	ĭ	1	Ö	Ŏ	Ö	0	0	0	Ö	0	0		0
743:	0	0	1	0	0	0	0	2	2	0	1	1	0		0
757: 771:	0	0 1	0	0	0 0	0 1	0	0	0 1	0	1 0	0	0		0
785:	0	0	0	0	0	0	0	0	ò	1	1	1	.0		1
799: 813:	0	0	0	0	0	.0	0	.0	0	0	0	0	0		1
827:	Ö	0	0	1	0 0	0	0	0 0	0 1	0	0	2 0	0		0
841:	1	1	0	0	0	0	1	0	ò	Ö	Ö	ő	Ö		Ö
855: 869:	1 0	0 1	0	0	0	1	0	1	0	1	0	0	2		0
883:	1	0	0	0 0	0	1	1 0	0 2	1	1 0	1	1 0	2 0		0
897:	0	0	1	O	0	0	0	0	0	0	0	0	.0		0
911: 925:	0 0	0 0	0 0	0	1 0	0	2 0	0 0	0	1	0	0	0		0
939:	Ō	0	1	0	0	0	1	0	0	1 0	0	0 1	0		0
953:	1	0	0	0	1	1	1	0	0	. 0	0	2	0		0
967: 981:	1 0	0 0	0	0 1	0 1	0	0 0	0 0	0	0	0	0	.0		1
995:	0	Ō	0	0	Ó	1	0	0	0	0	0	10	0		0
1009:	0	0	0	0	0	,0	0	0	Ō	Ö	ŏ	ŏ	1		Ö

Gross Sample Counts Within Peak Regions Generated: 10-JUL-2007 20:06:36.55

Detector ID: 6 Acquisition Start: 10-JUL-2007 15:30:01.01

Live Time: 0 02:50:03.00 Real Time: 0 02:50:03.00

Batch Id: 0707017A-RA Sample Id: 04

Sample Type: RA

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1 2 3	0	4597.96 5301.86 5848.04	41 53 43	03:	34.57	358.85 614.09 816.07	511	187	4.02E-03 5.19E-03 4.21E-03	13.7	* *1

Background Counts Within Peak Regions Generated: 10-JUL-2007 20:06:55.63

Acquisition Start: 6-JUL-2007 15:28:17.01

Live Time: 0 16:40:00.00 Real Time: 0 16:40:00.00

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
2	0	4604.16 5271.18 5810.03	10 10 13	03:	39.51	362.00 604.00 803.50	511	187	1.67E-04 1.67E-04 2.17E-04	31.6	

Net Sample Counts Within Peak Regions Generated: 10-JUL-2007 20:06:56.11

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec %Err	Fit
2	0	4597.96* 5301.86* 5848.04*	82 106 86	033	4.57	358.85 614.09 816.07	511	187	8.03É-03 16.0 1.04E-02 14.0 8.38E-03 15.7	,

Flag: "\*" = Peak area was modified by background subtraction

### VMS Nuclide Identification Report V3.0 Generated 10-JUL-2007 20:06:57

Configuration : MCA0: [AMSCOUNT] 00021072\$1

Analyses by : ROIPEAK V1.2, PEAKEFF V2.2, ENBACK V1.6, NID V3.3

Sample title : 5601-FSS-SU3-1014

Sample date : 25-MAY-2007 00:00:00 Acquisition date : 10-JUL-2007 15:30:01

Sample ID : 04 Sample quantity : 1.2095 gram

Sample type : RA Sample geometry : Detector name : 006 Detector geometry:

Energy tolerance: 100.00 keV Half life ratio: 8.00 Errors propagated: Yes Systematic Error: 3.00 %

Abundance limit : 75.00

### Post-NID Peak Search Report

It	Energy	Area FWHM Chann	el Left Pw %Err	Fit Nucl	ides Activity pCi/gram
0	4597.96*	82307.29 358.	85 279 167 31.9	RA-2	26 0.891
0	5301.86*	106334.57 614.		RN-2	
0	5848.04*	86378.72 816.		PO-2	

Detector	Parameter	Flag	Filename
1	ALL	Passed	D 001 NONE
2	ALL	Passed	D 002 NONE
3	ALL	Passed	D 003 NONE
4	OFFLINE		
5 <sup>:</sup>	OFFLINE		
6	ALL	Passed	D_006 NONE
7	OFFLINE		D_000_NONE
. 8	ALL .	Passed	D 008 NONE
9 .	ALL	Passed	D 009 NONE
10	ALL	Passed	D 010 NONE
11	ALL	Passed	D 011 NONE
12	ALL	Passed	
13	ALL	Passed	D_012_NONE
14	ALL	Passed	D_013_NONE
15	OFFLINE	rasseu	D_014_NONE
16	ALL	Passed	D 016 3703
17	OFFLINE	rasseu	D_016_NONE
18	ALL	Doomad	
19	ALL	Passed	D_018_NONE
20		Passed	D_019_NONE
21	OFFLINE	,	
22	OFFLINE		
23	OFFLINE		
	ALL	Passed	D_023_NONE
24	OFFLINE		•
25	ALL	Passed	D_025_NONE
26	OFFLINE	•	<del>-</del>
27	OFFLINE		
28	ALL	Passed	D 028 NONE
29	ALL	Passed	D_029 NONE
30	ALL	Passed	D 030 NONE
31	ALL	Passed	D 031 NONE
32	OFFLINE		-
33	ALL	Passed	D 033 NONE
34	ALL	Passed	D_034_NONE
35	OFFLINE		_
	OFFLINE		• .
	ALL	Passed	D 037 NONE
	ALL	Passed	D 038 NONE
	OFFLINE		
	OFFLINE		
	OFFLINE		
	ALL	Passed	D_042 NONE
	OFFLINE	• *	
	OFFLINE		
	ALL	Passed	D 045 NONE
	ALL	Passed.	D_046_NONE
47	OFFLINE	· · · · · <del>- · · · ·</del>	~HOME
	ALL	Passed	D_048 NONE
			~NONE
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DATE:	1.10.07 AI	PPROVAL TIME:	
	$\sim$ 1		

APPROVAL I

## SECTION X ANALYTICAL DATA (RADIUM-228)

Printed: 7/13/2007 9:22 AM Page 1 of 3

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07-07017 Ra228 Run 1

Eberline Services Oak Ridge Laboratory Analysis Sheet

Work Order	07-07017	Internal Fraction	Sample Desc	Glient ID	Login	Sample Date	Sample Allquot
Analysis Code	Ra228	δ	rcs	SOT		02/02/07 00:00	1.0000E+00
Run	~	02	MBL	BLANK		00:00 20/90/20	1.0000E+00
Date Received	7/5/2007	60	DUP	5601-FSS-SU3-1014	49	05/25/07 09:45	1.1637E+00
Lab Deadline	7/26/2007	40	00	5601-FSS-SU3-1014	49	05/25/07 09:45	1.2095E+00
Client	Environmental Chemical Corporation						
Project	Li Tungsten						
Report Level	4						
Activity Units	pCi						
Aliquot Units	ס		•				-
Matrix	SO						
Method	EPA 904.0 Modified						
Instrument Type	Alpha/Beta GPC						
Radiometric Tracer	Ba-133				-		
Radiometric Sol#	Ba-6a				.1		
Tracer Act (dpm/g)	1481.242	-					
Carrier	Yttirum				•		_
Carrier Conc (mg/ml)	31.81						
			-				

Printed: 7/13/2007 9:22 AM Page 2 of 3

07-07017 Ra228 Run 1

Eberline Services Oak Ridge Laboratory Analysis Sheet

	<del>, , , , , , , , , , , , , , , , , , , </del>			<del></del>	 	 					 	 				
SAF 2*	1.00	1.00	1.00	1.00			:								,	
SAF 1*	1.00	1.00	1.00	1.00	•								-			
Mean % Rec	90.97	92.92	83.18	87.88					•							
Grav % Rec	104.84	99.50	98.40	100.60										•		
Grav Filter Net (g)	0.0667	0.0633	0.0626	0.0640				:			,					
Grav Filter Final (g)	0.1590	0.1557	0.1544	0.1561										· :		
Grav Filter Tare (g)	0.0923	0.0924	0.0918	0.0921						:		.:				
Grav Carrier Added (ml)	2.000	2.000	2.000	2.000												
Radiometric % Rec	90.97	93.39	84.54	87.88												
Radiometric Tracer (pCi)	428.3	435.3	395.3	410.0			The second secon									
Tracer Total ACT (dpm)	1045.2	1034.8	1038.1	1035.7					*			-				
Tracer Aliquot (g)	0.7056	0.6986	0.7008	0.6992												
Sample Desc	SOT	MBL	DUP	8												
Internal Fraction	9	02	03	40												

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07-07017 Ra228 Run 1

Eberline Services Oak Ridge Laboratory Analysis Sheet

LCS	Internal Series	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep t0 Date/Time	Sep t0 By	Sep t1 Date/Time	Sep t1 By
07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:29 JPACHELLA 07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:29 JPACHELLA 07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:29 JPACHELLA 07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:29 JPACHELLA 07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:29 JPACHELLA 07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:29 JPACHELLA 07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/13/07	l .	rcs			07/06/07 06:47	JBARNARD	07/10/07 12:30	NOSNHOCO	07/13/07 07:50	DJOHNSON
07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07:50  07/06/07 06:47 JBARNARD 07/13/07 07:50  07/06/07 06:47 JBARNAR	ļ	MBL			07/06/07 06:47	JBARNARD	07/10/07 12:30	NOSNHOCO	07/13/07 07:50	DJOHNSON
07/06/07 08:29 JPACHELLA 07/06/07 06:47 JBARNARD 07/10/07 12:30 DJOHNSON 07/13/07 07/5	-	DUP			07/06/07 06:47	JBARNARD	.07/10/07 12:30	NOSNHOCO	07/13/07 07:50	DJOHNSON
	ļ	00	07/06/07 08:29	JPACHELLA	07/06/07 06:47	JBARNARD	07/10/07 12:30	NOSNHOCO	07/13/07 07:50	DJOHNSON
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Work Order: 07-07017-Ra228-1 Preliminary Data Report & Analytical Calculations

Eberline Services Oak Ridge Laboratory

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Blank Flag		ş																		- Contraction of the Contraction
MDA Flag	Š	ş	ş	충													-			
RPD Flag			NS NS						-											
LCS Flag	УО																			
LCS %R	87.14				-															
LCS Known	3.79E+01							-						1						
MDA	1.03E+00	1.04E+00	9.17E-01	7.35E-01															12	
Error Estimate	1.13E+00	4.42E-01	3.89E-01	3.28E-01						•										
Results	3.30E+01	3.44E-01	3.23E-01	6.29E-01												-				
Activity Units	pCl/g	bCl/g	pCI/g	bCl/g											-					
Client Identification	rcs	BLANK	5601-FSS-SU3-1014	5601-FSS-SU3-1014							•		<i>"</i> 2					-	7	
Sample Desc	SOJ	MBL	DUP	8										-		-		ė		
Nuclide	. RA-228	RA-228	RA-228	RA-228																
Lab	5	02	03	04																

900	L	Ra228	71070-70	Environmental Chemical Corporation
	พกษ	Analysis Code	Eberline Services Work Order	Client

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# Preliminary Data Report & Analytical Calculations Work Order: 07-07017-Ra228-1

Eberline Services Oak Ridge Laboratory

tt Time	7/13/2007 7:50	7/13/2007 7:50	7/13/2007 7:50	7/13/2007 7:50	Control of the Contro									-			1000
Sep t1 Date/Time	7/1	7/13	7/13	7/13													
	7/10/2007 12:30	7/10/2007 12:30	7/10/2007 12:30	7 12:30			<del> </del>										
Sep t0 Date/Time	7/10/200	7/10/200	7/10/200	7/10/2007 12:30												,	
SAF	1.00	1.00	1.00	1.00							1						
Mean % Rec	90.97	92.92	83.18	87.88				3.									
Grav % Rec	104.84	99.50	98.40	100.60													
Radiometric % Rec	90.97	93.39	84.54	87.88													-
	1.00E+00	1.00E+00	1.16E+00	1,21E+00													
Sample Aliquot	1.00	1.00	1.16	1.21					1								$\downarrow$
Sample Date	07/05/07 00:00	07/05/07 00:00	107 09:45	05/25/07 09:45		:			•		eks.	<b>-</b>			•		
	90//02	01/05	05/25/07 09	05/25												-	
Sample Desc	รูวา	MBL	DQ.	8				,					-				
Nuclide	RA-228	RA-228	RA-228	RA-228	-												
Lab Fraction	2	02	03	40													

	_			
9,19	L	Ra228	71070-70	Environmental Chemical Corporation
	Run	Analysis Code	Eberline Services Work Order	Cilent

**9**00

Run

### 4139 1.73333333 0.469663783 1.8 0.46172497 1.25 0.480063304 1.65 0.483813381 盂 Bkg 364 312 338 Counts 180 180 180 180 Count Carrier 8 **B**2 2 8 LB4110R LB4110R LB4110R LB4110R Detect Haifilife (days) 07/13/07 09:45 07/13/07 09:45 07/13/07 09:45 07/13/07 09:45 Counting Date/Time Sample Desc CS 92 MBL 8 RA-228 RA-228 Nuclide RA-228 RA-228 Lab Fraction 5 07 03 9

**71070-70** 

Eberline Services Work Order

Ra228

Analysis Code

Environmental Chemical Corporation

Client

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07-07017-Ra228-1 (pCi/g) in SO Tracer ID: Ba-6a

Count Room Report Client: Environmental Chemical Co

								<del></del>			T	 	 <del></del>	· · · · · ·	<del>                                     </del>	_
SAF 2*	1.00	1.00	1.00	1.00									-			
SAF 1*	1.00	1.00	1.00	1.00		•				- :		-	- :			
Radiometric % Rec	26.06	93.39	84.54	87.88												
Radiometric Tracer (pCi)	428.3000	435.3000	395.3000	410.0000												
Tracer ACT (dpm)	1045.1644	1034.7957	1038.0544	1035.6844	-				:							
Tracer Aliquot (g)	0.7056	0.6986	0.7008	0.6992				-								
Sample Aliquot	1.0000	1.0000	1.1637	1.2095						-						
Sample Date	07/05/07 00:00	07/05/07 00:00	05/25/07 09:45	05/25/07 09:45							-					
Cilent ID	SOT	BLANK	5601-FSS-SU3-1014	5601-FSS-SU3-1014												-
Sample Desc	SOT	MBL	DUP	8				-				·		-		
Internal Fraction	10	05	03	40				-	:							

Spike and Tracer Worksheet

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> Eberline Services Oak Ridge Laboratory

0.000 Error Estimate \* Les Doug Seus Witness Initials 0.0 Added pCi **Matrix Spike** 0.000 Error Estimate Technician Initials CS 0.0 Known pCi **Balance Printer Tapes** 0.000 Error Estimate 0.0 Added pC! **JBARNARD** 0.855 Error Estimate X X 19.00 Known pCI Tracer Volume Used (g) 7/6/2007 6:46 Volume Used (g) APIR. Appropriate Foi 0.6800 0.6800 0.6800 0.6800 Volume Used (g) Approx Addition Ra228 0.4082 SOT 0,7056 0.6986 0.7008 0.6992 Volume Used (g) Volume Used (g) 0.400 7/6/2007 7/6/2007 Solution Date 1481.242 7/6/2007 7/6/2007 Approx Addition 1481.242 1481.242 1481.242 7/6/2007 Tracers Solution Date Activity dpm/g LCS & Matrix Spikes 103.319 Activity dpm/g Ba-6a Ba-6a Ba-6a Ba-6a Internal Work Order # JoS 07-07017 Ba-133 Ba-133 Ba-133 Ba-133 Ra-10 # los Isotope Ra-228 Isotope fraction 63 62 9 5

**Aliquot Worksheet** 

Eberline Services - Oak Ridge Version 2.0 8/1999

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Page 1 of 1

H-3 Solids Only
ter Added H3 Dist
(ml) Aliq Water Added (ml) **JBARNARD MS Aliquot Data** Aliquot Net Equiv 1.0000E+00 1.0000E+00 1.1637E+00 1.2095E+00 **Aliquot Data** Aliquot 1.0000E+00 1.0000E+00 1.1637E+00 1.2095E+00 Ratio 7/26/2007 Lab Deadline Dilution Data Dil Factor grams Rpt Units No of Dils Analysis Code **Muffle Data** Ra228 Ratio Post/Pre Type LCS MBL DUP Environmental Chemical Corporation Sample Run 5601-FSS-SU3-1014 5601-FSS-SU3-1014 07-07017 Client ID BLANK S Lab Fraction 2 2 2 2

Comments

Date: 7 (4/07)

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Technician:

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## **Gravimetric Worksheet**

Eberline Services - Oak Ridge Version 1.0 9/1999

			The second secon		
Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
07-07017	7	Ra228	Yttirum	31.8100	DJOHNSON

TRetec	Environmental Chemical Corporation	Sample	Carrier Data		Filter Data		Gravimetric
		-	Carrier Added	Filter Tare	Filter Final	Filter Net	3,000
Fraction	Client ID	Type	(m)	6	(B)	(6)	Recovery
1	SOT	SOT	2.0000	0.0923	0.1590	0,0667	
- 1	BLANK	MBL	2.0000	0.0924	0.1557	0.0633	
- 7	DUP	PUP	2.0000	0.0918	0.1544	0.0626	98,40
1 7	5601-FSS-SU3-1014	8	2.0000	0.0921	0.1561	0,0640	
	-						
						4	
		-					
-							
	•						
		-					
-							

Date: 7 / 13 /07

Technician:

Eberline Services - Oak Ridge Prep Logbook Version 2.0 8/1999

Rough Sample Preparation Log Book

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	Date Sealed Date Keturned	Technician
7-07017 7/26/2007 7/5/2007 7/6/20	7/2/2007	JPACHELLA

	17010 10										
	71.070-70	7/26/2007	7/5/20	200	7/6/2007	07	3/2/2	7/7/2007	L.	<b>JPACHELLA</b>	4
									Ś		
Eberlin	Environment	Tare (g)	Gross	(a)	Net (g)	1	Per	Percent	Gal	Gamma	Special
Fraction	Client ID	Pan Wt	Wet Wt.	Dry Wt.	WetWt	Dry Wt.	Liquid	Solid	Dry Wit	I FPS W	lafo.
8	5601-FSS-SU3-1014	28.4000	1894.6500	1555.1600	1866,2500	1526,7600	18.19%	81.81%			
						1					
	7		•								
<del></del>											
	Comments	. <u>-</u>									
	Special Codes	H: Hot. O: (	Organic Ha	ard P. D.	H: Hot. O: Organic Hazard P. PCB Hazard R. Bush T. Other (end comments)	Buch T.	Othor (co.	940000000000000000000000000000000000000			
					בי ומדמומי ו	Masil, I.	Office (Se	Sillelling	1		

Date: Analysis: Rough Prep Logbook

Analysis: Ra228 Page No. 5721

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Sheet1

TOD	7/13/07 12:45	7/13/07 12:45	7/13/07 12:45	7/13/07 12:45
Voltage	1400	1400	1400	1400
Count Time	180	180	180	180
Beta	4139	364	338	312
			33	
Sample ID	0707017-01	0707017-02	0707017-03	0707017-04
Detector ID	19	82	B3	B4

			(ALL Ba	(ALL Backgrounds)		3	M=-13-J	4
Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	p <sub>J</sub>	Mean	ರ
LB4110A - A1	Alpha	7/10/2006	7/13/2007	1.00E-01	۵	-1.19E-01	1.30E-01	3.80E-01
LB4110A - A2	Alpha	7/10/2006	7/13/2007	1.00E-01	۵	-4.95E-02	1.02E-01	2.54E-01
LB4110A - A3	Alpha	7/10/2006	7/13/2007	1.00E-01	۵	-2.55E-01	1.15E-01	4.85E-01
LB4110A - A4	Alpha	7/10/2006	7/13/2007	1.00E-01	۵	-9.03E-02	1.60E-01	4.10E-01
LB4110A - B1	Alpha	7/10/2006	7/13/2007	8.33E-02	۵	-4.94E-02	9.44E-02	2.38E-01
LB4110A - B2	Alpha	7/10/2006	7/13/2007	1.17E-01	۵	-4.77E-02	2.41E-01	5.30E-01
LB4110A - B3	Aipha	7/10/2006	7/13/2007	2.67E-01	(F)	-5.14E-02	1.01E-01	2.54E-01
LB4110A - B4	Alpha	7/10/2006	7/13/2007	1.83E-01	<b>a</b>	-1.74E-01	8.65E-02	3.47E-01
LB4110A - C1	Alpha	7/10/2006	7/13/2007	2.83E-01	(E)	-5.10E-02	8.84E-02	2.28E-01
LB4110A - C2	Alpha	7/10/2006	7/13/2007	1.83E-01	ء(	-8.46E-02	1.01E-01	2.87E-01
LB4110A - C3	Alpha	7/10/2006	7/13/2007	3.33E-02	۵	-1.35E-01	1.19E-01	3.73E-01
LB4110A - C4	Alpha	7/10/2006	7/13/2007	1.00E-01	۵	-5.47E-02	9.13E-02	2.37E-01
LB4110A - D1	Alpha	7/10/2006	7/13/2007	6.67E-02	۵	-1.02E-01	1.53E-01	4.09E-01
LB4110A - D2	Alpha	7/10/2006	7/13/2007	0.005+00	۵	-2.43E-01	2.26E-01	6.96E-01
LB4110A - D3	Alpha	7/10/2006	7/13/2007	1.67E-01	Δ.	-1.34E-01	1.62E-01	4.58E-01
LB4110A - D4	Alpha	7/10/2006	7/13/2007	1.00E-01	۵	-4.47E-02	1.34E-01	3.14E-01
LB4110R - A1	Alpha	7/10/2006	7/13/2007	6.67E-02	۵	-5.13E-02	1.22E-01	2.95E-01
LB4110R - A2	Alpha	7/10/2006	7/13/2007	2,00E-01	٥.	-5.39E-02	1.75E-01	4.04E-01
LB4110R - A3	Alpha	7/10/2006	7/13/2007	1.83E-01	۵	-3.41E-02	1.28E-01	2.91E-01
LB4110R - A4	Alpha	7/10/2006	7/13/2007	8.33E-02	۵	-2.84E-02	1.13E-01	2.54E-01
LB4110R - B1	Alpha	7/10/2006	7/13/2007	6.67E-02	α.	-2.26E-02	1.15E-01	2.53E-01
LB4110R - B2	Alpha	7/10/2006	7/13/2007	3.33E-02	Ъ	-1.82E-02	1.30E-01	2.79E-01
LB4110R - B3	Alpha	7/10/2006	7/13/2007	1.67E-01	Ь	-3.75E-02	1.14E-01	2.66E-01
LB4110R - B4	Alpha	7/10/2006	7/13/2007	1.67E-01	Ь	-3.10E-02	1.24E-01	2.79E-01
LB4110R - C1	Alpha	7/10/2006	7/13/2007	1.83E-01	Ф	-2.01E-02	1.47E-01	3.14E-01
LB4110R - C2	Alpha	7/10/2006	7/13/2007	1.00E-01	a.	-3,41E-02	1.42E-01	3.19E-01
LB4110R - C3	Alpha	7/10/2006	7/13/2007	2.17E-01	۵	-6.92E-03	1.82E-01	3.72E-01
LB4110R - C4	Alpha	7/10/2006	7/13/2007	1,17E-01	Ь	-3,71E-02	1,33E-01	3.03E-01
LB4110R - D1	Alpha	7/10/2006	7/13/2007	6.67E-02	ď	-4,67E-02	1.46E-01	3.38E-01
LB4110R - D2	Alpha	7/10/2006	7/13/2007	8.33E-02	ď	-,1,19E-02	1.38E-01	2.87E-01
LB4110R - D3	Alpha	7/10/2006	7/13/2007	1.83E-01	ď	-4.52E-02	1.04E-01	2.54E-01
LB4110R - D4	Alpha	7/10/2006	7/13/2007	6.67E-02	Ь	-1.32E-02	1.33E-01	2.79E-01
LB5100 - 1	Alpha	7/10/2006	7/13/2007	7.00E-02	Δ.	-1.27E-02	9.52E-02	2.03E-01

			GPC Det (ALL Ba	GPC Detector Report (ALL Backgrounds)		7	Ju 7-13. B	5
Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	ਠਾ	Mean	UCL
LB4110A - A1	Beta	7/10/2006	7/13/2007	1.43E+00	Ф	-8.54E-01	1.27E+00	3.40E+00
LB4110A - A2	Beta	7/10/2006	7/13/2007	3.62E+00	Ч	-1.50E+00	2.80E+00	7.11E+00
LB4110A - A3	Beta	7/10/2006	7/13/2007	1.38E+00	đ	1.48E-01	1.21E+00	2.28E+00
LB4110A - A4	Beta	7/10/2006	7/13/2007	3.25E+00	Д	-4.18E-01	2.47E+00	5.35E+00
LB4110A - B1	Beta	7/10/2006	7/13/2007	1.18E+00	Δ.	5.78E-01	1.46E+00	2.35E+00
LB4110A - B2	Beta	7/10/2006	7/13/2007	1.12E+00	Δ.	7.54E-01	1.24E+00	1.73E+00
LB4110A - B3	Beta	7/10/2006	7/13/2007	1.75E+00	ď	1,04E+00	1.60E+00	2.16E+00
LB4110A - B4	Beta	7/10/2006	7/13/2007	1.28E+00	Д.	-1.96E-01	1.44E+00	3.07E+00
LB4110A - CI	Beta	7/10/2006	7/13/2007	2.00E+00	L	8.25E-01	1.39E+00	1.95E+00
LB4110A - C2	Beta	7/10/2006	7/13/2007	1.70E+00	۵	2.50E-01	1.64E+00	3.03E+00
LB4110A - C3	Beta	7/10/2006	7/13/2007	1.48E+00	۵.	8.73E-01	1.47E+00	2.07E+00
LB4110A - C4	Beta	7/10/2006	7/13/2007	1.52E+00	<u>a</u>	8.78E-01	1.44E+00	2.00E+00
LB4110A - D1	Beta	7/10/2006	7/13/2007	8.50E-01	ı	8.80E-01	1.37E+00	1.86E+00
LB4110A - D2	Beta	7/10/2006	7/13/2007	3.15E+05	u.	-4.93E+04	1.22E+03	5.17E+04
LB4110A - D3	Beta	7/10/2006	7/13/2007	1.35E+00	۵	3.43E-01	1,38E+00	2.41E+00
LB4110A - D4	Beta	7/10/2006	7/13/2007	3.68E+00	<b>x</b>	-8.27E-01	1.66E+00	4.14E+00
LB4110R - A1	Beta	7/10/2006	7/13/2007	1.10E+00	٩	8.61E-01	1.41E+00	1.96E+00
LB4110R - A2	Beta	7/10/2006	7/13/2007	1.45E+00	Д	6,70E-01	1.58E+00	2.49E+00
LB4110R - A3	Beta	7/10/2006	7/13/2007	6.75E+00	д	-1,01E+01	5.68E+00	2.15E+01
LB4110R - A4	Beta	7/10/2006	7/13/2007	1.33E+00	Ь	+2.05E-01	1.53E+00	3.27E+00
LB4110R - B1	Beta	7/10/2006	7/13/2007	1.73E+00	Д	9,28E-01	2.04E+00	3.15E+00
LB4110R - B2	Beta	7/10/2006	7/13/2007	1.80E+00	٩	9.90E-01	1.75E+00	2.51E+00
LB4110R - B3	Beta	7/10/2006	7/13/2007	1.65E+00	Ъ	3.55E-01	1.37E+00	2.38E+00
LB4110R - B4	Beta	7/10/2006	7/13/2007	1.25E+00	Ь	4.91E-01	1.31E+00	2.14E+00
LB4110R - C1	Beta	7/10/2006	7/13/2007	1.47E+00	۵	9.58E-01	1.59E+00	2.23E+00
LB4110R - C2	Beta	7/10/2006	7/13/2007	1.15E+00	Δ.	8,31E-01	1.41E+00	1.98E+00
LB4110R - C3	Beta	7/10/2006	7/13/2007	1.43E+00	Д.	-6.08E-01	1.52E+00	3.65E+00
LB4110R - C4	Beta	7/10/2006	7/13/2007	1.35E+00	d	5.10E-02	1.33E+00	2.60E+00
LB4110R - D1	Beta	7/10/2006	7/13/2007	1.28E+00	Q.	1.02E+00	1.53E+00	2.04E+00
LB4110R - D2	Beta	7/10/2006	7/13/2007	1.40E+00	Ф	8.76E-01	1.33E+00	1.79E+00
LB4110R - D3	Beta	7/10/2006	7/13/2007	1.45E+00	Ф	7.73E-01	1.43E+00	2.08E+00
LB4110R - D4	Beta	7/10/2006	7/13/2007	1.48E+00	Д	7.58E-01	1.26E+00	1.77E+00
LB5100 - 1	Beta	2/10/2006	7/13/2007	1.53E+00	Д	1.01E+00	1.40E+00	1.79E+00

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. D.444.04	Aipiia/ Deta	Zamulación Date	Codiff Date	20,000	A L	יייי	lieaii	000	
LB4110A - A1	Alpha	7/10/2006	7/13/2007	0.2489	α.	0.2109	0.2533	0.2958	
LB4110A - A2	Alpha	7/10/2006	7/13/2007	0.2271	О.	0.1904	0.2307	0.2710	
LB4110A - A3	Alpha	7/10/2006	7/13/2007	0.2256	Д	0.1910	0.2297	0.2683	
LB4110A - A4	Alpha	7/10/2006	7/13/2007	0.2449	Ь	0.2011	0.2417	0.2824	r
LB4110A - B1	Alpha	7/10/2006	7/13/2007	0.2419	Ь	0.2044	0.2452	0.2860	
LB4110A - B2	Alpha	7/10/2006	7/13/2007	0.2392	Ь	0.2000	0.2417	0.2834	· · · · ·
LB4110A - B3	Alpha	7/10/2006	7/13/2007	0.2533	д	0.2103	0.2521	0.2939	,
LB4110A - B4	Alpha	7/10/2006	7/13/2007	0.2519	d	0.2114	0.2537	0.2961	
LB4110A - C1	Alpha	7/10/2006	7/13/2007	0.2268	Д	0.1885	0.2331	0.2777	·
LB4110A - C2	Alpha	7/10/2006	7/13/2007	0.2315	d.	0.1925	0.2356	0.2787	,
LB4110A - C3	Alpha	7/10/2006	7/13/2007	0.2410	α.	0.1870	0.2446	0.3022	<del>,</del>
LB4110A - C4	Alpha	7/10/2006	7/13/2007	0.2431	d	0.2022	0.2463	0.2905	····
LB4110A - D1	Alpha	7/10/2006	7/13/2007	0.1663	(F)	0.2027	0.2478	0.2928	<del></del>
B4110A - D2	Alpha	7/10/2006	7/13/2007	0.0000	u.	0.2045	0.2678	0.3310	,
LB4110A - D3	Alpha	7/10/2006	7/13/2007	0.2682	Ь	0.2222	0.2687	0.3151	بنبسب
LB4110A - D4	Alpha	7/10/2006	7/13/2007	0.2125	ď	0.1819	0.2288	0.2757	
LB4110R - A1	Alpha	7/10/2006	7/13/2007	0.2487	Д	0.2208	0.2477	0.2745	<del></del>
B4110R - A2	Alpha	7/10/2006	7/13/2007	0.2180	Д	0.2066	0.2322	0.2578	·····
-B4110R - A3	Alpha	7/10/2006	7/13/2007	0.2348	Ь	0.2221	0.2369	0.2516	,
B4110R - A4	Alpha	7/10/2006	7/13/2007	0.2411	Д	0.2261	0.2479	0.2697	, i
LB4110R - B1	Alpha	7/10/2006	7/13/2007	0.2299	Ф	0.2179	0.2362	0.2544	·
LB4110R - B2	Alpha	7/10/2006	7/13/2007	0.2181	۵	0.2112	0.2270	0.2429	
LB4110R - B3	Alpha	7/10/2006	7/13/2007	0.2546	Φ.	0.2472	- 0.2555	0.2639	
LB4110R - B4	Alpha	7/10/2006	7/13/2007	0.2368	*	0.2356	0.2471	0.2587	
LB4110R - C1	Alpha	7/10/2006	7/13/2007	0.2158	۵	0.1657	0.2196	0.2735	·
B4110R - C2	Alpha	7/10/2006	7/13/2007	0.2154	ď	0.1710	0.2269	0.2829	
LB4110R - C3	Alpha	7/10/2006	7/13/2007	0.2435	۵	0.2026	0.2431	0.2835	
LB4110R - C4	Alpha	7/10/2006	7/13/2007	0.2333	۵	0.2138	0.2390	0.2642	
LB4110R - D1	Alpha	7/10/2006	7/13/2007	0.2291	Δ.	0.2166	0.2331	0.2497	
LB4110R - D2	Alpha	7/10/2006	7/13/2007	0.2580	Ф	0.2504	0.2582	0.2661	
LB4110R - D3	Alpha	7/10/2006	7/13/2007	0.2583	Q.	0.2506	0.2589	0.2673	
LB4110R - D4	Alpha	7/10/2006	7/13/2007	0.2150	Δ.	0.2034	0.2264	0.2493	
LB5100 - 1	Alpha	7/10/2006	7/13/2007	0.3458	Д.	0.3323	0.3456	0.3588	

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Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	רכד	Mean	NGL.
LB4110A - A1	Beta	7/10/2006	7/13/2007	0.5724	۵	0.4810	0.5791	0.6772
LB4110A - A2	Beta	7/10/2006	7/13/2007	0.4972	Д	0.4247	0.5264	0.6281
LB4110A - A3	Beta	7/10/2006	7/13/2007	0.5406	ď	0.4602	0.5529	0.6456
LB4110A - A4	Beta	7/10/2006	7/13/2007	0.5773	۵	0.4743	0.5688	0.6633
LB4110A - B1	Beta	7/10/2006	7/13/2007	0.5772	Ф	0.4858	0.5824	0.6790
LB4110A - B2	Beta	7/10/2006	7/13/2007	0.5706	Д	0.4779	0.5782	0.6785
٠,	Beta	7/10/2006	7/13/2007	0.6114	۵	0.5066	0.6054	0.7041
LB4110A - B4	Beta	7/10/2006	7/13/2007	0.5979	Д	0.4933	0.5979	0.7026
LB4110A - C1	Beta	7/10/2006	7/13/2007	0.5280	Q.	0.4341	0.5381	0.6422
LB4110A - C2	Beta	7/10/2006	7/13/2007	0.5321	ď	0.4523	0.5536	0.6550
LB4110A - C3	Beta	7/10/2006	7/13/2007	0.5638	d	0.4368	0.5718	0.7068
LB4110A - C4	Beta	7/10/2006	7/13/2007	0.5626	ď	0.4741	0.5766	0.6791
• 1	Beta	7/10/2006	7/13/2007	0.4736	ı	0.4794	0.5823	0.6852
LB4110A - D2	Beta	7/10/2006	7/13/2007	3.6325	ц	0.1238	0.6211	1.1184
LB4110A - D3	Beta	7/10/2006	7/13/2007	0.6112	Δ.	0.5091	0.6125	0.7159
LB4110A - D4	Beta	7/10/2006	7/13/2007	0.4903	۵	0.4191	0.5319	0.6448
LB4110R - A1	Beta	7/10/2006	7/13/2007	0.5808	d	0.5446	0.5885	0.6324
LB4110R - A2	Beta	7/10/2006	7/13/2007	0.5365	d	0.4877	0.5531	0.6184
LB4110R - A3	Beta	7/10/2006	7/13/2007	0.5564	Ь	0.5333	0.5690	0.6048
- J [	Beta	7/10/2006	7/13/2007	0.5960	Д	0.5660	0.5938	0.6216
	Beta	7/10/2006	7/13/2007	0.5560	Ф	0.5471	0.5744	0.6016
LB4110R - B2	Beta	7/10/2006	7/13/2007	0.5264	Ь	0.5172	0.5453	0.5734
LB4110R - B3	Beta	7/10/2006	7/13/2007	0.6020	Ф	0.5960	0.6110	0.6259
LB4110R - B4	Beta	7/10/2006	7/13/2007	0.5693	٩	0.5388	0.5837	0.6287
* 1	Beta	7/10/2006	7/13/2007	0.4906	Ь	0.4126	0.5152	0.6178
1	Beta	7/10/2006	7/13/2007	0.5170	Δ.	0.4295	0.5348	0.6401
	Beta	7/10/2006	7/13/2007	0.5654	۵.	0.4734	0.5676	0.6618
	Beta	7/10/2006	7/13/2007	0.5505	۵.	0.5174	0.5610	0.6045
	Beta	7/10/2006	7/13/2007	0.5418	Δ.	0.4889	0.5474	0.6060
<i>•</i>	Beta	7/10/2006	7/13/2007	0.6017	Д.	0.5848	0.5996	0.6144
	Beta	7/10/2006	7/13/2007	0.5897	Д	0.5756	0.5888	0.6019
•	Beta	7/10/2006	7/13/2007	0.5085	Д.	0.4750	0.5333	0.5916
LB5100 - 1	Beta	7/10/2006	7/13/2007	0.4697	۵	0.4615	0.4748	0.4880

# SECTION XI BARIUM-133 ANALYTICAL TRACER DATA

9 7/10/07

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE] SMP 070701701 GE3 BAFIL 111960.CN

Analyses by : PEAK V16.9 PEAKEFF V2.2

Client ID : SPIKE

Deposition Date

Sample Date : 10-JUL-2007 00:00:00 Acquisition date : 10-JUL-2007 13:47:43
Sample ID : 0707017-01 Sample Quantity : 1.00000E+00 filter

Sample type : FILTER Sample Geometry : 0
Detector name : GE3 Detector Geometry: BAFIL

Start channel : 25 End channel : 4096 Sensitivity : 3.00000 Gaussian : 10.00000

Critical level : No

cical	level	: No				·				
It	Energy	Area	Bkgnd	FWHM	Channel	Left, 1	Pw	Cts/Sec	%Err	Fit
3	62.38	335	60	1.75	63.08		17	3.72E-01	6.5	5.87E+00
	66.31	144	56	1.76	67.01		17	1.60E-01	13.2	
	71.43	27	53	1.77						
	77.59	23	35	1.62			15	2.57E-02		4.28E+00
2	81.53	933	53	1.46	82.22		15	1.04E+00	3.4	
0	94.12	75	88	2.85	94.81	91	10	8.34E-02	26.0	
3	112.38	272	73	1.86	113.06	108	13	3.02E-01	7.9	1.37E+00
3	116.86	64	60	1.87	117.54		13	7.11E-02	24.6	
0			54							•
0		30								
0		52					7			
										2.87E+00
			25	1.93						
			20	1.78						3.19E+00
				1.78						
		569								1.43E+00
5		19								
0	377.56	20								•
	384.46	156								1.12E+01
										1.60E+01
			7							
			4							
0						434				
0			0							
3	468.66	27	0	2.28	469.18					1.45E+00
3	471.84	6	0	2.08	472.36					
0	511.43	21	4	3.07	511.93	509	8	2.33E-02	27.4	
	It 3332203300022115505553330033	3 62.38 3 66.31 3 71.43 2 77.59 2 81.53 94.12 3 112.38 3 116.86 0 198.18 0 239.59 0 277.35 2 303.59 2 303.59 2 308.15 1 334.52 1 338.59 5 356.82 5 365.67 0 377.56 5 384.46 5 387.81 5 392.11 3 415.56 3 418.97 3 422.89 0 438.13 0 462.77 3 468.66 3 471.84	It       Energy       Area         3       62.38       335         3       66.31       144         3       71.43       27         2       77.59       23         2       81.53       933         0       94.12       75         3       112.38       272         3       116.86       64         0       198.18       18         0       239.59       30         0       277.35       52         2       303.59       159         2       308.15       27         1       334.52       94         1       338.59       20         5       365.67       19         0       377.56       20         5       384.46       156         5       387.81       229         5       392.11       56         3       415.56       56         3       415.56       56         3       422.89       15         0       438.13       99         0       462.77       7         3       468.66       <	It       Energy       Area       Bkgnd         3       62.38       335       60         3       66.31       144       56         3       71.43       27       53         2       77.59       23       35         2       81.53       933       53         0       94.12       75       88         3       112.38       272       73         3       116.86       64       60         0       198.18       18       54         0       239.59       30       51         0       277.35       52       36         2       303.59       159       23         2       308.15       27       25         1       334.52       94       20         1       338.59       20       16         5       356.82       569       8         5       365.67       19       5         0       377.56       20       8         5       384.46       156       3         5       392.11       56       0         3       415.56	It       Energy       Area       Bkgnd       FWHM         3       62.38       335       60       1.75         3       66.31       144       56       1.76         3       71.43       27       53       1.77         2       77.59       23       35       1.62         2       81.53       933       53       1.46         0       94.12       75       88       2.85         3       116.86       64       60       1.87         0       198.18       18       54       1.92         0       239.59       30       51       1.23         0       277.35       52       36       1.37         2       303.59       159       23       1.56         2       308.15       27       25       1.93         1       334.52       94       20       1.78         1       338.59       20       16       1.78         5       365.67       19       5       2.64         0       377.56       20       8       1.35         5       384.46       156       3	It Energy Area Bkgnd FWHM Channel  3 62.38 335 60 1.75 63.08 3 66.31 144 56 1.76 67.01 3 71.43 27 53 1.77 72.13 2 77.59 23 35 1.62 78.28 2 81.53 933 53 1.46 82.22 0 94.12 75 88 2.85 94.81 3 112.38 272 73 1.86 113.06 3 116.86 64 60 1.87 117.54 0 198.18 18 54 1.92 198.82 0 239.59 30 51 1.23 240.21 0 277.35 52 36 1.37 277.95 2 303.59 159 23 1.56 304.18 2 308.15 27 25 1.93 308.74 1 334.52 94 20 1.78 335.10 1 338.59 20 16 1.78 339.16 5 356.82 569 8 1.49 357.39 5 365.67 19 5 2.64 366.24 0 377.56 20 8 1.35 378.11 5 384.46 156 3 1.94 385.02 5 387.81 229 1 1.82 388.36 5 392.11 56 0 2.14 392.66 3 415.56 56 11 2.23 416.10 3 418.97 36 7 2.24 419.51 3 422.89 15 4 2.24 423.43 0 438.13 99 11 1.96 438.66 0 462.77 7 0 1.16 463.29 3 468.66 27 0 2.28 469.18 3 471.84 6 0 2.08 472.36	It         Energy         Area         Bkgnd         FWHM Channel         Left         1           3         62.38         335         60         1.75         63.08         59           3         66.31         144         56         1.76         67.01         59           3         71.43         27         53         1.77         72.13         59           2         77.59         23         35         1.62         78.28         77           2         81.53         933         53         1.46         82.22         77           0         94.12         75         88         2.85         94.81         91           3         112.38         272         73         1.86         113.06         108           3         116.86         64         60         1.87         117.54         108           0         198.18         18         54         1.92         198.82         196           0         239.59         30         51         1.23         240.21         236           0         277.35         52         36         1.37         277.95         275 <td< td=""><td>It         Energy         Area         Bkgnd         FWHM Channel         Left         Pw           3         62.38         335         60         1.75         63.08         59         17           3         66.31         144         56         1.76         67.01         59         17           3         71.43         27         53         1.77         72.13         59         17           2         77.59         23         35         1.62         78.28         77         15           2         81.53         933         53         1.46         82.22         77         15           0         94.12         75         88         2.85         94.81         91         10           3         112.38         272         73         1.86         113.06         108         13           3         116.86         64         60         1.87         117.54         108         13           0         239.59         30         51         1.23         240.21         236         8           0         277.35         52         36         1.37         277.95         275         7</td><td>It         Energy         Area         Bkgnd         FWHM Channel         Left         Pw         Cts/Sec           3         62.38         335         60         1.75         63.08         59         17         3.72E-01           3         66.31         144         56         1.76         67.01         59         17         1.60E-01           3         71.43         27         53         1.77         72.13         59         17         2.95E-02           2         77.59         23         35         1.62         78.28         77         15         2.57E-02           2         81.53         933         53         1.46         82.22         77         15         1.04E+00           0         94.12         75         88         2.85         94.81         91         10         8.34E-02           3         112.38         272         73         1.86         113.06         108         13         3.02E-01           3         116.86         64         60         1.87         117.54         108         13         7.11E-02           0         239.59         30         51         1.23         240.21&lt;</td><td>Tt Energy Area Bkgnd FWHM Channel Left Pw Cts/Sec %Err  3 62.38 335 60 1.75 63.08 59 17 3.72E-01 6.5 3 66.31 144 56 1.76 67.01 59 17 1.60E-01 13.2 3 71.43 27 53 1.77 72.13 59 17 2.95E-02 48.0 2 77.59 23 35 1.62 78.28 77 15 2.57E-02 39.0 2 81.53 933 53 1.46 82.22 77 15 1.04E+00 3.4 0 94.12 75 88 2.85 94.81 91 10 8.34E-02 26.0 3 112.38 272 73 1.86 113.06 108 13 3.02E-01 7.9 3 116.86 64 60 1.87 117.54 108 13 7.11E-02 24.6 0 198.18 18 54 1.92 198.82 196 6 2.00E-02 68.3 0 239.59 30 51 1.23 240.21 236 8 3.31E-02 46.2 0 277.35 52 36 1.37 277.95 275 7 5.74E-02 23.6 2 303.59 159 23 1.56 304.18 301 20 1.77E-01 8.9 2 308.15 27 25 1.93 308.74 301 20 3.05E-02 36.3 1 334.52 94 20 1.78 335.10 331 12 1.04E-01 12.2 1 338.59 20 16 1.78 339.16 331 12 2.24E-02 44.8 5 356.82 569 8 1.49 357.39 353 20 6.32E-01 4.2 5 365.67 19 5 2.64 366.24 353 20 2.14E-02 41.5 0 377.56 20 8 1.35 378.11 374 8 2.27E-02 32.5 5 384.46 156 3 1.94 385.02 382 16 1.74E-01 8.2 5 387.81 229 1 1.82 388.36 382 16 2.55E-01 7.1 5 392.11 56 0 2.14 392.66 382 16 6.19E-02 21.9 3 415.56 56 11 2.23 416.10 413 14 6.20E-02 17.5 5 387.81 229 1 1.82 388.36 382 16 2.55E-01 7.1 5 392.11 56 0 2.14 392.66 382 16 6.19E-02 21.9 3 415.56 56 11 2.23 416.10 413 14 6.20E-02 17.5 5 387.81 229 1 1.82 388.36 382 16 2.55E-01 7.1 5 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 3 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 3 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 418.97 36 7 2.24 419.51 413 14 6.76E-02 28.2 3 422.89 15 4 2.24 423.43 413 14 1.67E-02 47.6 0 438.13 99 11 1.96 438.66 434 8 1.10E-01 11.5 0 462.77 7 0 1.16 463.29 460 6 7.78E-03 37.8 3 468.66 27 0 2.28 469.18 466 14 3.04E-02 20.4 3 471.84 6 0 2.08 472.36 466 14 3.04E-02 20.4</td></td<>	It         Energy         Area         Bkgnd         FWHM Channel         Left         Pw           3         62.38         335         60         1.75         63.08         59         17           3         66.31         144         56         1.76         67.01         59         17           3         71.43         27         53         1.77         72.13         59         17           2         77.59         23         35         1.62         78.28         77         15           2         81.53         933         53         1.46         82.22         77         15           0         94.12         75         88         2.85         94.81         91         10           3         112.38         272         73         1.86         113.06         108         13           3         116.86         64         60         1.87         117.54         108         13           0         239.59         30         51         1.23         240.21         236         8           0         277.35         52         36         1.37         277.95         275         7	It         Energy         Area         Bkgnd         FWHM Channel         Left         Pw         Cts/Sec           3         62.38         335         60         1.75         63.08         59         17         3.72E-01           3         66.31         144         56         1.76         67.01         59         17         1.60E-01           3         71.43         27         53         1.77         72.13         59         17         2.95E-02           2         77.59         23         35         1.62         78.28         77         15         2.57E-02           2         81.53         933         53         1.46         82.22         77         15         1.04E+00           0         94.12         75         88         2.85         94.81         91         10         8.34E-02           3         112.38         272         73         1.86         113.06         108         13         3.02E-01           3         116.86         64         60         1.87         117.54         108         13         7.11E-02           0         239.59         30         51         1.23         240.21<	Tt Energy Area Bkgnd FWHM Channel Left Pw Cts/Sec %Err  3 62.38 335 60 1.75 63.08 59 17 3.72E-01 6.5 3 66.31 144 56 1.76 67.01 59 17 1.60E-01 13.2 3 71.43 27 53 1.77 72.13 59 17 2.95E-02 48.0 2 77.59 23 35 1.62 78.28 77 15 2.57E-02 39.0 2 81.53 933 53 1.46 82.22 77 15 1.04E+00 3.4 0 94.12 75 88 2.85 94.81 91 10 8.34E-02 26.0 3 112.38 272 73 1.86 113.06 108 13 3.02E-01 7.9 3 116.86 64 60 1.87 117.54 108 13 7.11E-02 24.6 0 198.18 18 54 1.92 198.82 196 6 2.00E-02 68.3 0 239.59 30 51 1.23 240.21 236 8 3.31E-02 46.2 0 277.35 52 36 1.37 277.95 275 7 5.74E-02 23.6 2 303.59 159 23 1.56 304.18 301 20 1.77E-01 8.9 2 308.15 27 25 1.93 308.74 301 20 3.05E-02 36.3 1 334.52 94 20 1.78 335.10 331 12 1.04E-01 12.2 1 338.59 20 16 1.78 339.16 331 12 2.24E-02 44.8 5 356.82 569 8 1.49 357.39 353 20 6.32E-01 4.2 5 365.67 19 5 2.64 366.24 353 20 2.14E-02 41.5 0 377.56 20 8 1.35 378.11 374 8 2.27E-02 32.5 5 384.46 156 3 1.94 385.02 382 16 1.74E-01 8.2 5 387.81 229 1 1.82 388.36 382 16 2.55E-01 7.1 5 392.11 56 0 2.14 392.66 382 16 6.19E-02 21.9 3 415.56 56 11 2.23 416.10 413 14 6.20E-02 17.5 5 387.81 229 1 1.82 388.36 382 16 2.55E-01 7.1 5 392.11 56 0 2.14 392.66 382 16 6.19E-02 21.9 3 415.56 56 11 2.23 416.10 413 14 6.20E-02 17.5 5 387.81 229 1 1.82 388.36 382 16 2.55E-01 7.1 5 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 3 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 3 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 418.97 36 7 2.24 419.51 413 14 6.20E-02 17.5 418.97 36 7 2.24 419.51 413 14 6.76E-02 28.2 3 422.89 15 4 2.24 423.43 413 14 1.67E-02 47.6 0 438.13 99 11 1.96 438.66 434 8 1.10E-01 11.5 0 462.77 7 0 1.16 463.29 460 6 7.78E-03 37.8 3 468.66 27 0 2.28 469.18 466 14 3.04E-02 20.4 3 471.84 6 0 2.08 472.36 466 14 3.04E-02 20.4

Summary of Nuclide Activity Sample ID : 0707017-01

Acquisition date: 10-JUL-2007 13:47:43

Total number of lines in spectrum

Number of unidentified lines

.29 25

Number of lines tentatively identified by NID 4 13.79%

Nuclide Type : FISSION

Wtd Mean Wtd Mean

Decay Corr 2-Sigma Decay Corr Uncorrected

pCi/filter Decay pCi/filter 2-Sigma Error %Error Flags Nuclide Hlife 0.794E+0218.53 BA-133

4.283E+02 1.00 4.282E+02 10.50Y

4.283E+02 4.282E+02 Total Activity:

Nuclide Type : NATURAL

Wtd Mean Wtd Mean

2-Sigma Decay Corr Decay Corr Uncorrected

\_\_\_\_\_

pCi/filter 2-Sigma Error %Error Flags Decay pCi/filter Nuclide Hlife

1.013E+02 14.54 6.963E+02 TH-234 4.47E+09Y 1.00 6.963E+02

> 6.963E+02 Total Activity: 6.963E+02

1.125E+03 Grand Total Activity: 1.125E+03

"M" = Manually accepted Flags: "K" = Keyline not found

"A" = Nuclide specific abn. limit "E" = Manually edited

Nuclide Line Activity Report

Sample ID : 0707017-01

Page: 3
Acquisition date: 10-JUL-2007 13:47:43

OK

Nuclide Type: FISSION

Uncorrected Decay Corr 2-Sigma

pCi/filter pCi/filter %Error Status %Eff Nuclide Energy %Abn 4.282E+02 18.53 OK BA-133 81.00 33.00\* 1.982E+01 4.283E+02 302.84 17.80 5.790E+00 4.634E+02 4.634E+02 33.88 OK

356.01 60.00 6.459E+00 4.408E+02 4.408E+02 17.72

Final Mean for 3 Valid Peaks = 4.283E+02+/-7.937E+01 ( 18.53%)

Nuclide Type: NATURAL

Uncorrected Decay Corr 2-Sigma

Nuclide Energy %Abn %Eff pCi/filter pCi/filter %Error Status TH-234 63.29 3.80\* 3.797E+01 6.963E+02 6.963E+02 14.54 OK

Final Mean for 1 Valid Peaks = 6.963E+02+/-1.013E+02 ( 14.54%)

Flag: "\*" = Keyline

Page: 4 Acquisition date : 10-JUL-2007 13:47:43

### ---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133 TH-234	4.283E+02 6.963E+02	7.937E+01 1.013E+02	1.920E+01 7.932E+01	3.213E+00 4.187E+00	22.305 8.778
Non-I	dentified Nuclides				•
Nuclide	Key-Line Activity K.L. (pCi/filter)Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57 CD-109 PA-231 PA-234 NP-237 AM-241	1.439E+00 -1.396E+02 0.000E+00 0.000E+00 -2.447E+01 7.790E+00	8.140E+00 1.364E+02 0.000E+00 0.000E+00 3.953E+01 5.058E+00	1.353E+01 1.635E+02 1.933E-01 1.251E-01 5.143E+01 9.266E+00	2.880E+00 1.984E+01 3.873E-03 2.507E-03 6.014E+00 4.080E-01	0.106 -0.854 0.000 0.000 -0.476 0.841

8 7/10/07

VAX/VMS Peak Search Report Generated 10-JUL-2007 14:18:39.60

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP\_070701702\_GE3\_BAFIL\_111963.CN

Analyses by : PEAK V16.9 PEAKEFF V2.2

Client ID : BLANK

Deposition Date

Sample Date : 10-JUL-2007 00:00:00 Acquisition date : 10-JUL-2007 14:03:17
Sample ID : 0707017-02 Sample Quantity : 1.00000E+00 filter

Sample ID : 0707017-02 Sample Quantity : I Sample type : FILTER Sample Geometry : 0

Detector name : GE3 Detector Geometry: BAFIL

Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:01.22 0.1%

Start channel : 25 End channel : 4096

Sensitivity: 3.00000 Gaussian: 10.00000

Critical level : No

Crit:	ical	Tevel	: NO								
Pk :	It	Energy	Area	Bkgnd	FWHM	Channel	Left,	Pw	Cts/Sec	%Err	Fit
1	1	62.26	250	74	1.45	62.96	59		2.78E-01		2.40E+00
2	1	66.36	131	. 79	1.46	67.06	59		1.46E-01		
3	0	81.51	948	119	1.34	82.20	78		1.05E+00	3.8	
	0	102.49	31	60	1.77		100		3.44E-02		
4 5 6	3	112.34	271	58	1.71	113.02	109		3.01E-01		1.33E+00
6	3	116.62	68	66	1.86	117.29	109		7.52E-02		
	0	131.59	16	41	2.14		130		1.73E-02		
8	0	277.78	60	54	1.44		274		6.68E-02		
7 8 9	1	303.51	168	13	1.63	304.10	298		1.87E-01		9.84E-01
10	1	308.33	52	. 9	1.76		298		5.78E-02		
11	.3	334.39	83	22	1.78		330		9.20E-02		7.80E-01
12	3	338.70	22	18	2.16		330		2.44E-02		
13	3	346.67	8	14	2.17		330		8.87E-03		
14	0	356.86	607	19	1.90		352	11	6.74E-01	4.3	
15	1	384.45	171	12	1.82	385.00	382		1.90E-01		3.98E+01
16	1	387.61	247	10	1.82		382		2.74E-01		
17	1	391.61	. 46	8	1.83		382		5.12E-02		
18	1	415.63	37	24	1.85		412		4.11E-02		3.97E+00
19	1	419.29	16	24	1.85		412		1.76E-02		
20	0	437.92	112	7	1.88		434		1.25E-01		
21	3	465.16	5	0	2.28		464				2.52E-01
22	3	468.78	20	0	1.87		464		2.25E-02		
23	0	473.38	10	0	1.99		472		1.11E-02		
24	0	485.43	11	4	1.53		483		1.17E-02		
25	0	511.48	22	2	4.10		507		2.41E-02		- 4 01
26	1	607.72	5	1	1.98		607				5.64E-01
27	1	610.73	9	1	1.98		607		1.02E-02		
28	0	840.65	. 8	0	1.20	841.00	838	6	8.89E-03	35.4	

Summary of Nuclide Activity Page: 2
Sample ID: 0707017-02 Acquisition date: 10-JUL-2007 14:03:17

Total number of lines in spectrum 28
Number of unidentified lines 23

Number of lines tentatively identified by NID 5 17.86%

Nuclide Type : FISSION

Wtd Mean Wtd Mean Decay Corr pCi/filter Uncorrected Decay Corr 2-Sigma Decay pCi/filter Nuclide 2-Sigma Error %Error Flags Hlife BA-133 10.50Y 4.353E+02 0.819E+02 18.82 1.00 4.353E+02

Total Activity: 4.353E+02 4.353E+02

Nuclide Type : NATURAL

Wtd Mean Wtd Mean Decay Corr Uncorrected Decay Corr 2-Sigma Decay pCi/filter pCi/filter Nuclide Hlife 2-Sigma Error %Error Flags TH-234 4.47E+09Y 5.199E+02 0.898E+02 1.00 5.199E+02 17.28

Total Activity: 5.199E+02 5.199E+02

Grand Total Activity: 9.551E+02 9.552E+02

Flags: "K" = Keyline not found "M" = Manually accepted

"E" = Manually edited "A" = Nuclide specific abn. limit

Sample ID: 0707017-02

Page: 3
Acquisition date: 10-JUL-2007 14:03:17

Status

Nuclide Type: FISSION

Uncorrected Decay Corr 2-Sigma
Nuclide Energy %Abn %Eff pCi/filter pCi/filter %Error

1.982E+01 4.353E+02 4.353E+02 OK BA-133 81.00 33.00\* 18.82 5.790E+00 4.899E+02 33.29 OK 302.84 17.80 4.900E+02 356.01 6.459E+00 4.702E+02 4.702E+02 OK 60.00 17.81

Final Mean for 3 Valid Peaks = 4.353E+02+/-8.192E+01 ( 18.82%)

Nuclide Type: NATURAL

Uncorrected Decay Corr 2-Sigma

Nuclide Energy %Abn %Eff pCi/filter pCi/filter %Error Status TH-234 63.29 3.80\* 3.797E+01 5.199E+02 5.199E+02 17.28 OK

Final Mean for 1 Valid Peaks = 5.199E+02+/-8.981E+01 ( 17.28%)

Flag: "\*" = Keyline

Page: 4 Acquisition date: 10-JUL-2007 14:03:17

### ---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133 TH-234	4.353E+02 5.199E+02	8.192E+01 8.981E+01	1.627E+01 9.741E+01	2.722E+00 5.142E+00	26.762 5.337
Non-	Identified Nuclides		, w		
Nuclide	Key-Line Activity K.L. (pCi/filter)Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57 CD-109 PA-231 PA-234 NP-237 AM-241	-6.347E+00 5.583E+01 0.000E+00 0.000E+00 1.906E+01 6.640E+00	8.748E+00 1.153E+02 0.000E+00 0.000E+00 3.259E+01 5.287E+00	1.273E+01 1.971E+02 1.933E-01 1.251E-01 5.627E+01 9.440E+00	2.710E+00 2.391E+01 3.873E-03 2.507E-03 6.579E+00 4.157E-01	-0.499 0.283 0.000 0.000 0.339 0.703

97/10/07

VAX/VMS Peak Search Report Generated 10-JUL-2007 14:34:38.41

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP 070701703 GE3 BAFIL 111964.CN

Analyses by : PEAK V16.9 PEAKEFF V2.2

Client ID : 5601-FSS-SU3-1014

Deposition Date

Sample Date : 10-JUL-2007 00:00:00 Acquisition date : 10-JUL-2007 14:19:20

Sample ID : 0707017-03 Sample Quantity : 1.00000E+00 filter

Sample Geometry Sample Geometry : 0
Detector Geometry: BAFIL Sample type : FILTER

Detector name : GE3

Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:01.16

: 25 Start channel End channel : 4096

Sensitivity : 3.00000 Gaussian : 10.00000

Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left,	Pw	Cts/Sec	%Err	Fit
1	1	62.31	282	55	1.45	63.01	59	11	3.13E-01	7.3	9.50E+00
2	1	66.17	102	56	1.46	66.87	59	11	1.13E-01	15.6	
3	1	81.44	861	51	1.48	82.13	78	11	9.57E-01	3.6	6.18E+00
4	1	84.18	32	39	1.49	84.86	78	11	3.53E-02	59.7	
5	1	112.21	228	48	1.53	112.88	109	16	2.53E-01	8.2	3.54E+00
6	1	116.46	39	46	1.54	117.14	109	16	4.30E-02	33.0	
2 3 4 5 6 7 8 9	2	237.70	13	3.0	1.86	238.32	235	16	1.42E-02	75.7	7.84E-01
8	2	246.13	13	30	1.87	246.75	235	16	1.42E-02	73.6	
.9	0	277.15	50	53	1.30	277.76	274	8	5.53E-02	29.2	
10	0	303.79	162	32	1.55	304.38	299	8	1.80E-01	9.9	
11	3	334.32	79	12	1.89	334.90	330	14	8.77E-02	13.9	3.19E+00
12	3.	338.98	27	. 12	2.16	339.56	330	14	2.96E-02	33.1	
13	.0	356.80	545	17	1.91	357.37	352	11	6.06E-01	4.5	•,
14	1	384.44	129	- 16	1.82	384.99	382	10	1.43E-01	10.6	6.68E+00
15	1	387.61	213	42	1.81	388.17	382	10	2.37E-01	9.4	
16	0	407.13	12	6	3.24	407.68	403	.8	1.33E-02	45.6	
17	3	412.67	8	2	2.03	413.21	411	16	8.65E-03	46.3	2.06E+00
18	3	415.55	49	5	2.23	416.09	411	16	5.42E-02	19.0	
19	3	419.02	25	6	2.24	419.56	411	16	2.80E-02	37.7	
20	.3	422.90	14	7	2.24	423.44	411	16	1.54E-02	51.1	*
21	1	433.64	6	1	1.86	434.17	433	9	6.93E-03	33.0	4.62E+00
22	1	437.60	95	1	1.64	438.13	433	9	1.06E-01	10.8	
23	0	469.16	22	9	1.96	469.68	466	6	2.45E-02	30.2	√.
24	0	511.68	16	2	3.97	512.17	508	8	1.78E-02	29.2	•
25	0	599.67	8	0	2.83	600.12	597	. 6	8.89E-03	35.4	

Summary of Nuclide Activity Sample ID: 0707017-03

Acquisition date : 10-JUL-2007 14:19:20

Page:

Total number of lines in spectrum

25

Number of unidentified lines

21 4

Number of lines tentatively identified by NID

16.00%

Nuclide Type : FISSION

Wtd Mean Wtd Mean

Uncorrected Decay Corr Decay Corr 2-Sigma

Nuclide Hlife Decay pCi/filter pCi/filter 2-Sigma Error %Error Flags

BA-133 10.50Y 1.00 3.952E+02 3.953E+02 0.738E+02 18.68

Total Activity: 3.952E+02 3.953E+02

Nuclide Type : NATURAL

Wtd Mean Wtd Mean

Uncorrected Decay Corr Decay Corr 2-Sigma

\_\_\_\_\_

Nuclide Hlife Decay pCi/filter pCi/filter 2-Sigma Error %Error Flags

TH-234 4.47E+09Y 1.00 5.869E+02 5.869E+02 0.946E+02 16.11

Total Activity: 5.869E+02 5.869E+02

Grand Total Activity: 9.821E+02 9.822E+02

Flags: "K" = Keyline not found "M" = Manually accepted

"E" = Manually edited "A" = Nuclide specific abn. limit

Nuclide Line Activity Report

Sample ID: 0707017-03

Acquisition date : 10-JUL-2007 14:19:20

Nuclide Type: FISSION

Uncorrected Decay Corr 2-Sigma

%Abn pCi/filter pCi/filter %Error Nuclide Energy %Eff Status BA-133

81.00 33.00\* 1.982E+01 3.952E+02 3.953E+02 18.68 OK 17.80 5.790E+00 4.720E+02 4.720E+02 35.00 OK 302.84 OK

4.226E+02 356.01 60.00 6.459E+00 4.226E+02 18.03

Final Mean for 3 Valid Peaks = 3.953E+02+/-7.384E+01 ( 18.68%)

Nuclide Type: NATURAL

Uncorrected Decay Corr 2-Sigma

%Abn pCi/filter pCi/filter %Error Nuclide Energy %Eff Status TH-234 63.29 3.80\* 3.797E+01 5.869E+02 5.869E+02 16.11

Final Mean for 1 Valid Peaks = 5.869E+02+/-9.458E+01 ( 16.11%)

Flag: "\*" = Keyline

Acquisition date: 10-JUL-2007 14:19:20

### ---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133 TH-234	3.953E+02 5.869E+02	7.384E+01 9.458E+01	1.730E+01 8.895E+01	2.896E+00 4.696E+00	22.843 6.598
Non-3	Identified Nuclides	· · · · · · · · · · · · · · · · · · ·			
Nuclide	Key-Line Activity K.L. (pCi/filter)Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	-1.409E+00	7.319E+00	1.169E+01	2.489E+00	-0.121
CD-109	2 2505.01	0.4007.01	1.498E+02	1 0100.01	
	-3.259E+01	9.499E+01	1.4900+02	1.818E+01	-0.218
PA-231	-3.259E+01 0.000E+00	0.000E+00	1.498E+02 1.933E-01	3.873E-03	0.000
PA-231 PA-234			·= : == : = : · =		
	0.000E+00	0.000E+00	1.933E-01	3.873E-03	0.000

VAX/VMS Peak Search Report Generated 10-JUL-2007 14:50:05.57

90/01/00

Configuration : DKA100: [GAMMA.SCUSR.ARCHIVE] SMP\_070701704\_GE3\_BAFIL\_111965.CN

Analyses by : PEAK V16.9 PEAKEFF V2.2

Client ID : 5601-FSS-SU3-1014

Deposition Date :

Sample Date : 10-JUL-2007 00:00:00 Acquisition date : 10-JUL-2007 14:34:46

Sample ID : 0707017-04 Sample Quantity : 1.00000E+00 filter

Sample type : FILTER Sample Geometry : 0

Detector name : GE3 Detector Geometry: BAFIL

Start channel : 25 End channel : 4096

Sensitivity: 3.00000 Gaussian: 10.00000

Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	1	62.23	243	61	1.45	62.93	59	12	2.70E-01	8.1	3.74E+00
2	1	66.27	115	65	1.46	66.96	59	12	1.27E-01	14.0	
2 3	1	81.43	893	56	1.48	82.12	77		9.92E-01		1.11E+01
4	1	84.18	18	47	1.49	84.86	· 77		1.94E-023		
5	. 0	93.16	48	79	1.55	93.84	89		5.39E-02		
6	0	101.13	43	87	1.57	101.82	98		4.80E-02		4
7	4	112.38	256	47	1.67	113.05	109		2.84E-01		2.01E+00
8	4	116.73	52	46	2.05	117.41	109		5.77E-02		
9	0	161.74	14	65	0.96	162.39	159	6	1.56E-02	94.1	
10	0	277.43	45	19	1.31	278.04	276	5	5.00E-02	20.8	
11	.3	303.68	177	10	1.60	304.27	300	15	1.97E-01	8.0	1.61E+00
12	3	307.88	31	16	2.13	308.47	300		3.40E-02		
13	3	311.37	10	18	2.13	311.96	300	15	1.10E-02	83.7	
14	0	334.10	63	48	1.32	334.68	331	7	7.02E-02	19.8	
15	5	356.84	551	18	1.63	357.41	353	21	6.12E-01	4.4	3.49E+00
16	5	365.53	22	28	2.64	366.09	353	21	2.48E-02	45.7	•
17	1	384.33	127	. 11	1.82	384.89	381	15	1.41E-01	9.5	8.95E+00
18	1	387.61	206	9	1.82	388.17	381	15	2.29E-01	8.8	
19	1	392.28	49	6	1.83	392.83	381	15	5.42E-02	17.1	
20	1	415.59	44	12	1.85	416.13	410	17	4.93E-02	20.0	9.22E-01
21	1	419.29	22	8	1.85	419.83	410	17	2.49E-02	35.9	
22	1	422.63	12	7	1.85	423.17	410	17	1.36E-02	58.4	
23	0	438.08	110	11	2.02	438.61	434	9	1.22E-01	11.0	3
24	5	463.48	5	1	1.71	464.00	463		5.10E-03		2.94E+00
25	5	468.48	26	2	2.76	469.00	463	13	2.84E-02	25.4	
		471.95	10	1	2.77	472.47	463		1.15E-02		
	0	512.06	17	8	2.70	512.56	508	10	1.91E-02	38.5	
28	0	603.10	. 9	0	3.50	603.56	601	6	1.00E-02	33.3	
25 26 27 28	5 0	471.95	10	1	2.77 2.70	472.47 512.56	463 508	13 10	1.15E-02 1.91E-02	63.4 38.5	

Summary of Nuclide Activity Sample ID : 0707017-04

Page: Acquisition date: 10-JUL-2007 14:34:46

28 Total number of lines in spectrum 24 Number of unidentified lines Number of lines tentatively identified by NID

14.29%

Nuclide Type : FISSION

Wtd Mean Wtd Mean Decay Corr Decay Corr 2-Sigma Uncorrected pCi/filter 2-Sigma Error %Error Flags Decay pCi/filter Nuclide Hlife 18.58 0.762E+02 4.100E+02 4.100E+02 BA-133 10.50Y 1.00 4.100E+02 4.100E+02 Total Activity:

Nuclide Type : NATURAL Wtd Mean Wtd Mean Decay Corr pCi/filter Decay Corr 2-Siqma Uncorrected 2-Sigma Error %Error Flags Decay pCi/filter Hlife Nuclide 0.882E+02 17.43 5.059E+02 1.00 5.059E+02 TH-234 4.47E+09Y 5.059E+02 5.059E+02 Total Activity:

9.160E+02 Grand Total Activity: 9.159E+02

"M" = Manually accepted Flags: "K" = Keyline not found "A" = Nuclide specific abn. limit "E" = Manually edited

Nuclide Line Activity Report

Sample ID : 0707017-04

Page: 3
Acquisition date: 10-JUL-2007 14:34:46

OK

Nuclide Type: FISSION

Uncorrected Decay Corr 2-Sigma

pCi/filter pCi/filter Nuclide Energy %Abn %Eff %Error Status BA-133 81.00 33.00\* 1.982E+01 4.100E+02 4.100E+02 18.58 OK 5.169E+02 302.84 17.80 5.790E+00 5.170E+02 32.95 OK

356.01 60.00 6.459E+00 4.269E+02 4.270E+02 17.91

Final Mean for 3 Valid Peaks = 4.100E+02+/-7.620E+01 ( 18.58%)

Nuclide Type: NATURAL

Uncorrected Decay Corr 2-Sigma

Nuclide Energy %Abn %Eff pCi/filter pCi/filter %Error Status TH-234 63.29 3.80\* 3.797E+01 5.059E+02 5.059E+02 17.43 OK

Final Mean for 1 Valid Peaks = 5.059E+02+/-8.81-9E+01 ( 17.43%)

Flag: "\*" = Keyline

Page: 4 Acquisition date: 10-JUL-2007 14:34:46

### ---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133 TH-234	4.100E+02 5.059E+02	7.620E+01 8.819E+01	1.692E+01 9.791E+01	2.831E+00 5.169E+00	24.238 5.167
Non-I	dentified Nuclides				
Nuclide	Key-Line Activity K.L. (pCi/filter)Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57 CD-109 PA-231 PA-234 NP-237 AM-241	-1.084E+00 2.672E+01 0.000E+00 0.000E+00 1.458E+01 6.975E+00	8.149E+00 1.199E+02 0.000E+00 0.000E+00 3.458E+01 5.155E+00	1.304E+01 1.790E+02 1.933E-01 1.251E-01 5.297E+01 9.299E+00	2.776E+00 2.172E+01 3.873E-03 2.507E-03 6.192E+00 4.095E-01	-0.083 0.149 0.000 0.000 0.275 0.750

# SECTION XII ANALYTICAL STANDARD

# Date 1/16/95 Initials M

## QA/QC REVIEWED CERTIFICATE OF CALIBRATION **ALPHA STANDARD SOLUTION**

Radionuclide:

**U-238NAT** 

Customer:

TMA EBERLINE

Half Life:

 $(4.468 \pm 0.005) \times 10^9$  years

P.O.No.:

OR2778

Catalog No.:

7338

January 1 1995 Reference Date:

12:00 PST.

Source No.:

479-50

Contained Radioactivity: (Total U) 8.016 µCi

Contained Radioactivity: (Total U) 297 kBq

**Description of Solution** 

a. Mass of solution:

65,2896 g in a 50 ml flame sealed ampoule Uranyl Nitrate in H2O

b. Chemical form:

c. Carrier content:

g/ml @ 20°C.

d. Density:

Approximately 1.3202

Radioimpurities

Refer to attached technical data sheet

Radioactive Daughters

Refer to attached technical data sheet

Radionuclide Concentration

(Total U) 0.1228

μCi/g.

Method of Calibration

Activity calculations are based upon known specific activity and mass.

Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:

 $\pm 3.0\%$ 

b. Random uncertainty in assay:

+0.0%

c. Random uncertainty in weighing(s):

+2.0%

d. Total uncertainty at the 99% confidence level:

+3.6%

### **NIST Traceability**

This calibration is implicitly traceable to the National Institute of Standards and Technology.

### Leak Test(s)

See reverse side for Leak Test(s) applied to this source.

### Notes

1. Nuclear data were taken from "Table of Radioactive Isotopes", edited by Virginia S. Shirley, 1986.

2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).

Date Signed



ISOTOPE PRODUCTS LABORATORIES 3017 N. San Fernando Blvd. BURBANK, CALIFORNIA 91504

818 • 843 • 7000 FAX 818 • 843 • 6168

© EBERLINE	QUALITY CONT	ROL PROGRAM	•	
Rev.8; 11/01/03 Title: Radioactive Reference Str	inderds Solutions & Records			
	EBERLINE SERVICES - ( RADIOACTIVE REF PRIMARY DILUTION	OAK RIDGE LABORATO ERENCE SOLUTIONS N RECERTIFICATION P 009	RY	. <b></b>
	NOT (10) 470 50	CURRENT DATE		
SOLUTION REFERE	The second secon	SOLUTION		
rincipal Radionuclide <sup>34, 235, 238</sup> U	Half Life, Years 4.468E+09		Half Life, Days 1.832E+12	
1500101100110	5,238 6E+00 μCi μCi per gram	Reference Date	e 4/1/1995 0:00	
Tot	poule /Solution Gross Empty Ampoule Solution Net al Activity in Ampoule tion of Standard Solution te HNQ	97.6400 Weight, Grams 32.5020 Weight, Grams 65.1380 Weight, Grams 8.0160 μCI	•	
Dilution Instructions:	Diluti	ion Solvent Used	1M HNO <sub>3</sub>	
Dilute to a vo	ume of 1000.00 millili	iters		
Certified Total Activity of	8.0160 µCi Which Eq	ıuals 1.780E+0	7 dpm at the date listed a	ibove
And after dilution the ac	tivity of this solution is 1.77	955E+04 dpm/mleference corrected	rity concentration is based on a date listed above. All activitie is the date and time of analys y data processing software.	s are
	•			
		Expiration Date	e: December 13, 2007	
			er e	
Recertified By	ni John	Dat	e: 12/13/2006 0:00	
Verified & Approved By	Deary ()	Dat	e: 1/9/07	
OC Approval	11/2/100	O Dat	e: 1110/07	



Rev.8; 11/01/03
Title: Redicective Reference Standards Solutions & Records

### **EBERLINE SERVICES - OAK RIDGE LABORATORY** RADIOACTIVE REFERENCE STANDARD SOLUTIONS

SECONDAI	RY DILUTION RECER	TIFICATION	-
Solution Reference # IPI	MP-009	Date Solution #	12/13/2006 0:00 U-8a
Principal Radionuclide Ha	4.468E+09		Half Life, Days 1.632E+12
Radionuclide of Interest 234, 235. 238 U Parent Solution Conc. 1.7796E+04 dp	om/ml	Reference Date	1/1/1995 0:00
Chemical Composition of Star Uranly Nitrate in 1M HNO <sub>3</sub>	ndard Solution	]	
Dilution Instructions:	Dilution \$	Solvent Used	1M HNO <sub>3</sub>
SECONDA	ARY VOLUMETRIC DI	LUTION	
Vol. Parent Solution: 4.0000 m Total Activity: 7.1182E+04 dp Final Volume: 1000.00 m	pm Final Ac	tivity Concentration:	7.1182E+01 dpm/ml
NOTES:	refere	nce date listed above	ime of analysis by the
Isotopic Distribution as: U-238 Atom % = 48.239	48249 = 34.345 dpm/ml 0225 = 1.602 dpm/ml		December 13, 2007
Isotopic ratios from manufacturer's data sheet			
Recertified By	Safe S	Date	12/13/2006 0:00
Verified & Approved By	4	Date	: 19,107
QC Approval	Walen	Date	: <u>1/10/07</u>

## RECORD COPY

# Tracer Solution for Environmental Analysis & Disequilibrium Studies

## **Product Description & Measurement Certificate**

Description

Principal radionuclide:

uranium 232 (U-232)

Product code: UDP10050

01 March 2000

5.35€ granas

5.035 millilitres

Daughter Nuclide:

Th-228

Batch Number: 92/232/67

6.739E+03 becquerels per gram of solution

1.821E-01 microcuries per gram of solution

Measurement

Reference date:

Radioactive concentration U-232

which is equivalent to

Mass of solution Volume of solution Total activity of U-232

which is equivalent to

3.61E+04 becauerels 9.76E-01 microcuries

Method of measurement (see reverse of this certificate)

Random uncertainty is: ± 0.7%

Systematic uncertainty: ± 0.5%

Overall uncertainty in the radioactive concentration quoted above:  $\pm 1.7\%$ 

Overall uncertainty is defined on the reverse of this certificate.

Radionuclidic Purity

Accuracy

Any radioactive impurities measured are listed below, expressed as percentages

of the activity of the principle radionuclide at the reference date.

Th-228 and daughter activity removed 2 Feb 2000

U-232 daughters activity will increase with time. By alpha 88% U-232, 12% daughters on 1/3/00

Isotopic Purity

The isotopic composition, expressed as atom per cent at the reference date.

Not measured

Chemical Composition Calculated weight of U-232, 4.42E-08 grams, as 2M HNO3 solution in a flame sealed glass vial.

This Tracer solution has been produced 'carrier free'.

**Physical** 

Recommended half life of uranium 232: 6.980E+01 years

Data

Principle energies of alpha emissions (MeV): 5.263 31.7%, 5.320 68.0%

Branching ratio for alpha emission: 100%

Calculated specific activity of uranium 232: 8.167E+05 Bq per microgram U-232.

Remarks

For safety information and notes to ensure correct usage by all persons handling this radioactive Tracer

solution please read the instructions accompanying the package.

AEA Technology operates a quality management system which has been independently audited and

approved to ISO 9001.

Approved Signatory

Project Ref. AE2315

Roger Wiltshire

Prepared and characterised in the UK, for world wide distribution by Isotrak, AEA Technology, QSA.



Rev.8; 11/01/03

Title: Radioactive Reference Standards Solutions & Records	
EBERLINE SERVICES - OAK	RIDGE LABORATORY
RADIOACTIVE REFERE	INCE SOLUTIONS
PRIMARY DILUTION RE	ECERTIFICATION
MP 009	•
	CURRENT DATE 12/14/2006 0:00
SOLUTION REFERENCE # AEA/Amersham 92/232/67	SOLUTION # U-10
Principal Radionuclide Half Life, Years	Half Life, Days
7.200E+01	2.630E+04
	the state of the s
Radionuclide 232U	Reference Date 3/1/2000 0:00
Certified Activity 9.760E-01 μCi	
Certified Concentration µCi per gram	
	——————————————————————————————————————
Ampoule /Solution Gross	Weight, Grams
Empty Ampoule	Weight, Grams
Solution Net  Total Activity in Ampoule 0.976	Weight, Grams i0 μCi
Total Activity in Ampoule 0.970	ојрог
Chemical Composition of Standard Solution	
<sup>232</sup> U(NO <sub>3</sub> ) <sub>6</sub> in 2M HNO <sub>3</sub>	7
0(1403/6 III ZM) F11403	<b></b>
O(NO3/6 III ZMI FINO3	
	Solvent Used 2M HNO <sub>3</sub>
	Solvent Used 2M HNO <sub>3</sub>
Dilution Instructions: Dilution S	
Dilution Instructions: Dilution S  Dilute to a volume of 1000.00 milliliters	
Dilution Instructions: Dilution S	
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original
Dilution Instructions: Dilution S  Dilute to a volume of 1000.00 milliliters	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals  And after dilution the activity of this solution is 2.167E+0	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.  Expiration Date: December 14, 2007
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals  And after dilution the activity of this solution is 2.167E+6	This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.  Expiration Date: December 14, 2007  Date: 12/14/2006 0:00
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals  And after dilution the activity of this solution is 2.167E+0	2.167E+06 dpm at the date listed above  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.  Expiration Date: December 14, 2007
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters  Certified Total Activity of 0.9760 µCi Which Equals  And after dilution the activity of this solution is 2.167E+6	This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.  Expiration Date: December 14, 2007  Date: 12/14/2006 0:00



MP-009

Rev.8; 11/01/03

Title: Radioactive Reference Standards Solutions & Records

# EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE STANDARD SOLUTIONS SECONDARY OF LITTON RECEPTIFICATION

RADIC	SECONDARY DILUTION RE		
Solution D	MP-009 eference # AEA/Amersham 92/232	Date Date	12/14/2006 0:00
Principal Radionuclide	Half Life, Years		Half Life, Days
232U	7.200E+01		2.630E+04
السكا	7.200E+01]	L	2.000=704]
Radionuclide of Interest Parent Solution Conc. 2.	<sup>232</sup> U 167É+03 dpm/ml	Reference Date	3/1/2000 0:00
Chemical Compo	osition of Standard Solution HNO <sub>3</sub>		
Dilution Instructions:	Dilut SECONDARY VOLUMETRI	<b>,</b>	2M HNO <sub>3</sub>
	JEJONONII I JEJMENII	·	
Vol. Parent Solution:	10.0000 ml	_	
		Activity Concentration:	2.1670E+01 dpm/ml
Final Volume:	1000.00 ml		
NOTES:	re-	nis activity concentration ference date listed above procted to the date and to boratory data processing	. All activities are me of analysis by the
	•		<del>-</del>
		Expiration Date:	December 14, 2007
			**
Recertified By	2	Date:	12/14/2006 0:00
Verified & Approved By	Dearcy)	Date:	119/07
QC Approval	Malane	Date:	1/11/07

# TMA EBERLAND TT4944 ERTIFICATE OF CALIBRAT LPHA STANDARD SOLUTION

Radionuclide Half Life:

Th-230

Customer: P.O.No.:

 $(7.54 \pm 0.03) \times 10^{\circ}4$  years

Catalog No.:

7230

Reference Date:

November 1 1991

12:00 PST.

Source No.:

388-116

Contained Radioactivity:

1.036

Description of Solution

a. Mass of solution:

5.0042

grams.

b. Chemical form:

Th(NO3)4 in 0.1N HNO3 None added

c. Carrier content: d. Density:

1.0016

gram/ml @ 20°C.

Radioimpurities

See attached technical data sheet

Radioactive Daughters

See attached technical data sheet

Radionuclide Concentration

0.207

uCi/gram.

Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

### Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:

+2.0%

b. Random uncertainty in assay:

+0.5%

c. Random uncertainty in weighing(s):

+0.2%

d. Total uncertainty at the 99% confidence level:

+2.7%

#### **NIST Traceability**

This calibration is implicitly traceable to the National Institute of Standards and Technology.

#### **Notes**

- 1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
- 2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay(and later NIST certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)

ISOTOPE PRODUCTS LABORATORIES

1800 No. Keystone Street., Burbank, California 91504

(818) 843 - 7000



Rev.8; 11/01/03

Title: Radioactive Reference Standards Solutions & Records	
EBERLINE SERVICES - O/	· · · · · · · · · · · · · · · · · · ·
RADIOACTIVE REFE	the state of the s
PRIMARY DILUTION	
MP	108
	CURRENT DATE 12/30/2006 0:00
SOLUTION REFERENCE # IPL 388-116	SOLUTION # 1995 Th-1997
Principal Radionuclide Half Life, Years	Hàif Life, Days
<sup>230</sup> Th 7.540E+04	2.754E+07
Radionuclide 230 Thorium	Reference Date 11/1/1991 0:00
Certified Activity 1.036E+00 μCi Certified Concentration μCi per gram	
Certified Colicendationpci per grain	
Ampoule /Solution Gross 9.2	660 Weight, Grams
	218 Weight, Grams
The state of the s	442 Weight, Grams
Total Activity in Ampoule 1.0	<u>360</u> μCi
Chemical Composition of Standard Solution	<del></del>
<sup>230</sup> Th(NO <sub>3</sub> ) <sub>4</sub> in 0.1N HNO <sub>3</sub>	
Dilution Instructions: Dilution	Solvent Used 0.1N HNO <sub>3</sub>
Dilute to a volume of 1000.00 millilite	rs
Certified Total Activity of 1.0360 μCi Which Equa	
And after dilution the activity of this solution is 2.300E	This activity concentration is based on the original
And after dilution the activity of this solution is 2.300L	reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data
	processing software.
	Expiration Date: December 30, 2007
Recertified By	Date: 12/30/2006 0:00
00	
Verified & Approved By ( )	Date: 1/9/0>
7.1957	- 11.1 -
QC Approval Chun Jaleme	Date:
	<u> </u>



Rev.8; 11/01/03

Title: Radioactive Reference Standards Solutions & Records

# EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE STANDARD SOLUTIONS

•	SECONDARY DILUT	ION RECERTIFICATION	
	MP-009	Date	12/30/2006 0:00
Solution	Reference # IPL 388-118		Th-16
Principal Radionuclide	Half Life, Ye	ars	Half Life, Days
230 <sub>Th</sub>	7.540E+0		2.754E+07
	· ·	<del></del>	
Radionuclide of Interest	<sup>230</sup> Thorium	Reference Date	11/1/1991 0:00
Parent Solution Conc.	2.30E+03 dpm/ml		11/1/1001 0:00
-			
			·
Chemical Com	position of Standard Solu	ition	
<sup>230</sup> Th(NO <sub>3</sub> ) <sub>4</sub> in 0			
(mass 49 - 8 - 4 - 48 - 49 - 49 - 49 - 49 - 4			
Dilution Instructions:		Dilution Solvent Used	0.1N HNO <sub>3</sub>
•	SECONDARY VOLU	JMETRIC DILUTION	
Vol. Parent Solution:	10.0000 ml		
Total Activity:	2.2999E+04 dpm	Final Activity Concentration:	2.2999E+01 dpm/ml
Final Volume:	1000.00 ml	· ·	
		This activity concentration	
NOTES:		reference date listed above	
		corrected to the date and ti	
	•	laboratory data processing	software.
		•.	
	•		-
		Expiration Date:	December 30, 2007
		· · · · · · · · · · · · · · · · · · ·	
	in a righting manage		
Recertified By	Mi m	Date:	12/30/2006 0:00
	$A \cap A \rightarrow A$	<u> </u>	12/30/2000 0:00
Verified & Approved By (	Dearce	Date:	1/9/07
OC Annuario	71/21/	7	110107
QC Approval	- CAMINE POX	Date:	11010/

# CERTIFICATE OF CALIBRATION - ALPHA STANDARD SOLUTION

Radionuclide:

Th-232

Customer:

TMA EBERLINE

Half Life:

 $(1.405 \pm 0.006) \times 10^{10}$  years

P.O.No.:

VH1632

Catalog No.:

7232 435-104-2 Reference Date: No

November 1 1993

Source No.:

C

Contained Radioactivity:

(Th-232) 0.0933

иСi.

,

Contained Radioactivity:

(Th-232) 3.45

kBq.

**Description of Solution** 

a. Mass of solution:

11.9712 g (in a 10 ml flame sealed ampoule)

b. Chemical form:

Th(NO3)4 in water

c. Carrier content:

None added
Approx. 1.21

g/ml @ 20°C.

d. Density:

Radioimpurities

None detected (other than daughters).

Radioactive Daughters

Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Po-212, Tl-208

Radionuclide Concentration

(Th-232) 0.00779

μCi/g.

Method of Calibration

Activity calculations are based upon known specific activity and mass.

Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:

+3.0%

b. Random uncertainty in assay:

±0.0%

c. Random uncertainty in weighing(s):

 $\pm 2.0\%$ 

d. Total uncertainty at the 99% confidence level:

±3.6%

### NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

### Leak Test(s)

See reverse side for Leak Test(s) applied to this source.

### Notes

1. Nuclear data were taken from "Table of Radioactive Isotopes", edited by Virginia S. Shirley, 1986.

2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).



QUALITY CONTROL

Nov. 8, 1993

Date Signed

ISOTOPE PRODUCTS LABORATORIES

1800 North Keystone Street Burbank, California 91504

(818) 843 - 7000



Rev.8; 1/10/03

Title: Radioactive Reference Standards Solutions & Records

# EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE SOLUTIONS PRIMARY DILUTION RECERTIFICATION MP 009

PRIMARY DILUTION RECERTIFICATION  MP 009	
CURRENT DATE 12/14/2006 0:00	
SOLUTION REFERENCE # IPL 435-104-2 SOLUTION # Th-8	
Principal Radionuclide Half Life, Years Half Life, Days	
232Th, 223Th 5.132E+12	
Radionuclide 232 & 228 Th Reference Date 11/4/(1993 0:00)  Certified Activity 9.330Ε-02 μCi  Certified Concentration μCi per gram	
Ampoule /Solution Gross 18.8415 Weight, Grams	
Empty Ampoule 6.9296 Weight, Grams	
Solution Net 11.9119 Weight, Grams	
Total Activity in Ampoule 0.0933 μCi	
Chemical Composition of Standard Solution	
Th(NO <sub>3</sub> ) <sub>4</sub> in H2O	
Dilution Instructions:  Dilute to a volume of 1000.00 milliliters	
Certified Total Activity of 0.0933 µCi Which Equals 2.071E+05 dpm at the date listed ab	
And after dilution the activity of this solution is 2.071E+02 dpm/m!  This activity concentration is based on a reference date listed above. All activities to the date and time of analysis by the laprocessing software.	s are corrected
Expiration Date: December 14, 2007	
Recertified By  Date: 12/14/2006 0:00  Verified & Approved By  Date: (9/0)	
2010	
QC Approval Clustial and Date: 1/11/07	



MP-009

Rev.8; 1/10/03

Title: Radioactive Reference Standards Solutions & Records

# EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE STANDARD SOLUTIONS

SECOI	NDARY DILUTION RECER	TIFICATION	
	MP-009	Date	12/14/2006 0:00
Solution Reference	# IPL 435-104-2	Solution #	Th-8b
Principal Radionuclide	Half Life, Years		lalf Life, Days
228 8 232 Th	1.405E+10		5.132E+12
		· ·	· · · · · · · · · · · · · · · · · · ·
938 1 939		·	
Radionuclide of Interest 228 & 232 Th	4	Reference Date	11/171993 0:00
Parent Solution Conc. 2.07E+02	_dpm/ml		N.
			•
. <b>#</b> 			
			•
Chemical Composition of	Standard Solution		
Th(NO <sub>3</sub> ) <sub>4</sub> in 1% HNO <sub>3</sub>		1.	-
		J	
Dilution Instructions:	Dilution S	olvent Used	% Nitric Acid
SECO	NDARY VOLUMETRIC DIL	UTION	
Vol. Parent Solution: 500.000	n]mi		
Total Activity: 1.0355E+0		ivity Concentration:	1.0355E+02 dpm/ml
Final Volume: 1000.0		Litty Comoditation.	1.0000E-02 upilimi
	<del></del>		
			s based on the original
NOTES:		ce date listed above.	
٠		ed to the date and tin	
	laborat	ory data processing s	ioftware.
			141 -
			01 M
-		Expiration Date:	December 14, 2006
		Expiration bate.	December 14, 2009
•			en de la companya de la companya de la companya de la companya de la companya de la companya de la companya de
7			
Recertified By	~~d	Date:	12/14/2006 0:00
0	-3/4	_	1 /
Verified & Approved By	argy	Date: _	1/2/02
000 00000000	72160	Po. 4	1/11/07
QC Approval	wind a	_ Date: _	(1110)



24937 Avenue Tibbitts Valencia, California 91355

An Eckert & Ziegler Company

Tel 661 • 309 • 1010 Fax 661-257-8303

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

Radionuclide:

Th-229

Half-life:

7340 ± 160 years

Catalog No.:

7229

Source No.:

867-54

Customer: P.O. No.:

**EBERLINE SERVICES** 

00009633

Reference Date: Contained Radioactivity: 1.013

15-Jan-02 12:00 PST иCi

37.48

kBq

(Th-229 only)

**Physical Description:** 

A. Mass of solution:

5.0147 g in 5 mL flame-sealed ampoule

B. Chemical form:

Th(NO<sub>3</sub>)<sub>4</sub> in 0.1M HNO<sub>3</sub>

C. Carrier content:

10ug Th/mL

D. Density:

1.0016 g/mL @ 20°C.

Radioimpurities:

None detected (daughters in equilibrium)

Radionuclide Concentration:

0.2020

μCi/g,

7.474

kBq/q

Method of Calibration:

This source was prepared from a weighed aliquot of solution whose activity in µCi/g was determined using gamma ray spectrometry.

Peak energy used for integration:

193.5 keV

Branching ratio used:

0.0441 gammas per decay

**Uncertainty of Measurement:** 

A. Type A (random) uncertainty:

0.7 %

B. Type B (systematic) uncertainty:

3.0 %

C. Uncertainty in aliquot weighing:

0.0 %

D. Total uncertainty at the 99% confidence level:

3.1 %

### Notes:

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from IAEA Technical Report Series No. 261.
- This solution has a working life of 5 years.

9- Jun-02
Date Signed

IPL Ref. No.:

867-54

**Medical Imaging Laboratory** 

**Industrial Gauging Laboratory** 

1800 North Keystone Street Burbank, California 91504



MP-009

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Rev.	Ο,	1/ 1	wu	~

PROBLEM APPLACES AL		
EBERLINE SERVICES - UA	K RIDGE LABORAT	DRY
RADIOACTIVE REFER	ENCE SOLUTIONS	
PRIMARY DILUTION F	RECERTIFICATION	
MP O	9	
	CURRENT DATE	1/3/2007 0:00
SOLUTION REFERENCE # IPL 867-54	SOLUTION #	Th-18
Principal Radionuclide Half Life, Years		Half Life, Days
<sup>229</sup> Th 7.340E+03	-	2.681E+06
	ā* <b>.</b>	
Radionuclide 229Th	Reference Date	1/15/2002 0:00
Certified Activity 1.013E+00 μCi		
Certified Concentration μCl per gram		
Ampoule /Solution Gross 8.77	52 Weight, Grams	
	91 Weight, Grams	
	61 Weight, Grams	
	30 μCI	
to the second second second second second second second second second second second second second second second	<del></del>	
Chemical Composition of Standard Solution		
<sup>229</sup> Th(NO <sub>3</sub> ) <sub>4</sub> in 0.1M HNO <sub>3</sub>		
Diluate a la sacratica de	0-1	0.4 M LINO
Dilution Instructions: Dilution	Solvent Used	0.1 M HNO <sub>3</sub>
Dilute to a volume of 1000.00 milliliters	2	
Didde to a Volume of 1000.00 Immusi		
· · · · · · · · · · · · · · · · · · ·	• 	
Certified Total Activity of 1.0130 μCi Which Equal		dpm at the date listed above
	s 2.249E+06	dpm at the date listed above vity concentration is based on the original
Certified Total Activity of 1.0130 μCi Which Equal  And after dilution the activity of this solution is 2.249Ε-	s 2.249E+06 This act	vity concentration is based on the original e date listed above. All activities are corrected
	s 2.249E+06 This active reference to the de	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory data
	s 2.249E+06 This active reference to the de	vity concentration is based on the original e date listed above. All activities are corrected
	s 2.249E+06 This active reference to the de	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory data
	s 2.249E+06 This active reference to the de	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory dataing software.
	2.249E+06  This act reference to the deprocess	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory dataing software.
	2.249E+06  This act reference to the deprocess	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory dataing software.
And after dilution the activity of this solution is 2.249E-	2.249E+06 This act reference to the de process Expiration Date:	vity concentration is based on the original e date listed above. All activities are corrected its and time of analysis by the laboratory dataing software.  January 3, 2008
	2.249E+06  This act reference to the deprocess	vity concentration is based on the original e date listed above. All activities are corrected its and time of analysis by the laboratory dataing software.  January 3, 2008
And after dilution the activity of this solution is 2.249E-	2.249E+06 This activation to the disprocess  Expiration Date:	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory dataing software.  January 3, 2008
And after dilution the activity of this solution is 2.249E-	2.249E+06 This act reference to the de process Expiration Date:	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory dataing software.  January 3, 2008
And after dilution the activity of this solution is 2.249E-	2.249E+06 This activation to the disprocess  Expiration Date:	vity concentration is based on the original e date listed above. All activities are corrected to and time of analysis by the laboratory data ing software.  January 3, 2008  1/3/2007 0:00



	9/29/99

Title: Radioactive Reference Standards Solutions & Records

# **EBERLINE SERVICES - OAK RIDGE LABORATORY**

RAI		E STANDARD SOLUTION ON RECERTIFICATION	IS
	MP-009	Date	1/3/2007 0:00
Solution	Reference # IPL 867-54	Solution #	
Principal Radionuclide	Half Life, Yea		Half Life, Days
229 Th	7.340E+03		2.681E+06
Radionuclide of Interest Parent Solution Conc.	2.25E+03 dpm/ml	Reference Date	1/15/2002 0:00
Chemical Con TH(NO <sub>3</sub> ) <sub>4</sub> in 0.	nposition of Standard Solut 1M HNO <sub>3</sub>	tion	
Dilution Instructions:		Dilution Solvent Used	0.1M HNO <sub>3</sub>
	SECONDARY VOLUM	METRIC DILUTION	
Vol. Parent Solution:	10.0000 ml		
Total Activity:	2.2490E+04 dpm	Final Activity Concentration	2.2490E+01 dpm/ml
Final Volume:	1000.00 mt		
NOTES:		This activity concentration reference date listed above corrected to the date and laboratory data processing	e. All activities are time of analysis by the
•		Expiration Date	: January 3, 2008
Recertified By Verified & Approved By	Connect	Date	10 103
QC Approval	Mult blo	Date	Wal on
<del></del>	<del></del>	_, ,,	



# National Institute of Standards & Technology Certificate

### Standard Reference Material 4251C Barium-133 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive barium-133 chloride, non-radioactive barium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of ionization chambers and solid-state gamma-ray spectrometry systems.

#### Radiological Hazard

The SRM ampoule contains barium-133 with a total activity of approximately 2.5 MBq. Barium-133 decays by electron capture and during the decay process X-rays and gamma rays with energies from 4 to 400 keV are emitted. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]\*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

#### **Chemical Hazard**

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

### Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least June 2004.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

#### Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group and D.B. Golas, Nuclear Energy Institute Research Associate.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899 October 1994 Thomas E. Gills, Chief Standard Reference Materials Program



Rev.8; 11/10/03

Title: Radioactive Reference Standards Solutions & Records

# EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE SOLUTIONS PRIMARY DILUTION RECERTIFICATION QCP 009-1

	PRIMARY DILUTION R QCP 00		
SOLUTION REL	FERENCE # NIST SRM4251C	CURRENT DATE SOLUTION #	
Principal Radionuclide	Half Life, Years	1 00201101111	Half Life, Days
<sup>133</sup> Barium	1.048E+01		3.828E+03
·	***************************************		
Radionuclide	193 Barium	Reference Date	9/1/1993 0:00
Certified Activity Certified Concentration	μCi 1.318E+01 μCi per gram	•	#
Oetuned Concentration[	1.010E-011por per gram		
		81 Weight, Grams	
		82 Weight, Grams	
		99 Weight, Grams	
			·
	position of Standard Solution	<del></del>	
<sup>133</sup> BaCl <sub>2</sub> in 1M	HCI		
Dilution Instructions:	Dilution	Solvent Used	1M HCI
<b>5</b> 11. 4. 4			
Dilute to	a volume of 1000.00 milliliters		
			· · ·
Certified Total Activity of	66.5577 μCi Which Equal	s 1.478E+08	dpm at the date listed above
And offer dilution the	activity of this solution is 1.478E+	OE down/mi This act	livity concentration is based on the original
And alter directors the	activity of this solution is 1.470E-		ce date listed above. All activities are corrected ate and time of analysis by the laboratory data
			sing software.
			- 1
		Expiration Date	November 6, 2007
	· .		110101100101
			•
Recertified By	1 Low which	Date	: 11/18/06
Treatment by	0.0		
Verified & Approved By	(intenter )	Date	: 11/27/06 : 11/27/06
QC Approval	(elli Hala	Date	· ulanlal
QO Appiovai	y un paxent	Date	1101106



QCP-009

Rev.8; 11/10/03

Title: Radioactive Reference Standards Solutions & Records

# EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE STANDARD SOLUTIONS

	SECONDARY DILUTION RECERT	IFICATION		
	QCP-009-1-A	Date	11/6/06	
Solution Refer	rence # NIST SRM4251C	Solution #	Ba-6a	
Principal Radionuclide	Half Life, Years	Hal	f Life, Days	
<sup>133</sup> Ba	1.048E+01		3.828E+03	
			*	
Radionuclide of Interest 133	Ba	Reference Date	9/1/1993 0:00	
	E+05 dpm/ml	Maiarailea Data	9/1/1383 0.00	
		•		
. ••				
Chemical Composit	ion of Standard Solution			
133BaCl <sub>2</sub> in 1M HCl				
3.32		· · · · · · · · · · · · · · · · · · ·		
Dilution Instructions:	Dilution Sc	olvent Used 1M	HCI	
	SECONDARY VOLUMETRIC DIL	UTION		
Vol. Parent Solution:	25.0000 ml			
		vity Concentration:	3.6950E+03 dpm/ml	
Final Volume:	1000:00 ml	:		
	This act	livity concentration is	based on the original	
NOTES:		ce date listed above. A		
·		ed to the date and time		
	laborate	ory data processing so	ftware.	
			•	
		Expiration Date:	lovember 6, 2007	
<u>.</u>				
Ch.	_			
Recertified By		Date:	11/18/06	
		-	1 2 4	
Verified & Approved By	Diarry	Date:	11/27/06	
QC Approval	Mus Halene	Date:	11/27/06	

# CERTIFICATE OF CALIBRATIONA/OC ALPHA STANDARD SOLUTION

Radionuclide:

Ra-226

Customer:

TMA EBERLINE

Half Life:

1600 ± 7 years

P.O.No.:

VH1888

Catalog No.:

7226

Reference Date:

February 1 1994

Source No.:

453-26

Contained Radioactivity: (Ra-226) 1.001 µCi.

12:00 PST.

Contained Radioactivity: (Ra-226)

37.0 kBq.

**Description of Solution** 

a. Mass of solution:

5.1864 g (in a 5 ml Flame Sealed Ampoule)

b. Chemical form:

Ra(NO3)2 in 1 N HNO3

c. Carrier content:

None added

1.0318

g/mi @ 20°C.

d. Density: Radioimpurities

None detected(other than daughters)

Radioactive Daughters

Rn-222, Po-218, At-218, Pb-214, Bi-214, Po-214, Tl-210, Pb-210, Bi-210, Po-210 and Tl-206.

Radionuclide Concentration

(Ra-226) 0.1929

μCi/g.

Method of Calibration

Weighed aliquots of the solution were assayed using gamma spectrometry:

Energy peak(s) integrated under: 186

0.0351

gamma rays per decay.

Uncertainty of Measurement

Branching ratio(s) used:

a. Systematic uncertainty in instrument calibration:

+3.4%

b. Random uncertainty in assay:

+3.1%

c. Random uncertainty in weighing(s):

+0.2%

d. Total uncertainty at the 99% confidence level:

±4.6%

**NIST Traceability** 

This calibration is implicitly traceable to the National Institute of Standards and Technology.

Leak Test(s)

See reverse side for Leak Test(s) applied to this source.

Notes

1. Nuclear data were taken from "Table of Radioactive Isotopes", edited by Virginia S. Shirley, 1986.

2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).

ana U. Kun **OUALITY CONTROL** 

Date Signed

ISOTOPE PRODUCTS LABORATORIES

1800 North Keystone Street Burbank, California 91504

(818) 843 - 7000



MP 009

Rev.8; 11/01/03 Title: Radioactive Reference	ce Standards Solutions & Re	ecords .	•										
EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE SOLUTIONS PRIMARY DILUTION RECERTIFICATION MP 009													
											CURRENT DATE	12/29/2006 0:00	
									ERENCE # IPL 453-26		SOLUTION #	Ra-5	
Principal Radionuclide  226 Radium	Half Life,			Half Life, Days									
radium	1.600E	E+U3	·	5.844E+05									
Radionuclide	<sup>228</sup> Radium		Reference Date	2/1/1994 0:00									
	1.001E+00 μCi												
Certified Concentration	μCi per g	ram											
	Ampoule /Solution G	ross	Weight, Grams										
	Empty Amp		Weight, Grams										
• ,	Solution		Weight, Grams	•									
	Total Activity in Amp	oule 1.0010	ŊμCi										
Chemical Com	position of Standard	Solution											
<sup>226</sup> Ra(NO <sub>3</sub> ) <sub>2</sub> in 1			7										
Dilution Instructions:	•	Dilution Se	olvent Used	1M HNO <sub>3</sub>									
Dilute to a volume of 1000.00 milliliters													
Certified Total Activity of	1.0010]μCi	Which Equals		dpm at the date listed above									
And after dilution the activity of this solution is 2.222E+03 dpm/ml  This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.													
,			***	·-									
			Expiration Date:	December 29, 2007									
	$\mathcal{T}$												
Diluted By_	by Cali	<u></u>	_ Date:	12/29/2006									
Verified & Approved By	2 march	7	– Date:										
QC Approval	WAN !	Co.	_ Date:	1/11/07									
CC Approval	Church to		Date.	-11111/									



MP 009

Rev.8; 11/01/03

Title: Radioactive Reference Standards Solutions & Records

# EBERLINE SERVICES - OAK RIDGE LABORATORY RADIOACTIVE REFERENCE STANDARD SOLUTIONS SECONDARY OF LETTON RECEPTION.

SECONDARY DILUTION RECERTIFICATION							
	MP 009	Date	12/29/2006 0:00				
Solution Reference #		Solution #	Ra-5b				
Principal Radionuclide	Half Life, Years		laif Life, Days				
<sup>228</sup> Radium	1.600E+03		5.844E+05				
· · · · · · · · · · · · · · · · · · ·							
Radionuclide of Interest 228 Radium	]	Reference Date	2/1/1994 0:00				
Parent Solution Conc. 2.22E+03	dpm/ml	••••••••••••••••••••••••••••••••••••••		`			
Chemical Composition of	Standard Solution						
<sup>228</sup> Ra(NO <sub>3</sub> ) <sub>2</sub> in 1M HNO <sub>3</sub>		_}	•	·			
Dilution instructions:	Dilution	Solvent Used	IM HNO <sub>3</sub>				
SECONDARY VOLUMETRIC DILUTION							
Vol. Parent Solution: 20.0000 Total Activity: 4.4440E+04 Final Volume: 1000.00	dpm Final Ac ml This a refere	tivity Concentration: ctivity concentration ince date listed above.	s based on the orig All-activities are	inal			
NOTES:		ted to the date and tire story data processing					
•			 				
		Expiration Date:	December 29, 2007				
Recertified By	>1>	Date:	1/4/2006 0:00				
Verified & Approved By	sch 5	Date:	119/07				
QC Approval	Dalan	Date:	1/11/02				

Phone (404) 352-8677 Fax (404) 352-2837



### CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

61680-416

Ra-228 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated using a germanium gamma spectrometer system.

Radionuclide purity and calibration were checked using a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:

Ra-228

ACTIVITY (dps):

3.586 E3

HALF-LIFE:

5.75 years

CALIBRATION DATE:

June 4, 2001 12:00 EST

TOTAL UNCERTAINTY\*:

5.1%

SYSTEMATIC:

3.6%

RANDOM:

1.5%

\*99% Confidence Level

Impurities: γ-impurities (other than decay products) <0.1%

5.00872 grams 0.1M HCl solution with 50  $\mu$ g/g Ba carrier.

P O NUMBER 00008864, Item 1

SOURCE PREPARED BY:

M. D. Currie, Radiochemist

Q A APPROVED:

Acmed 6/8/01



Rev.8; 1/10/03

Title: Radioactive Reference Standards Solutions & Records

## **EBERLINE SERVICES - OAK RIDGE LABORATORY** RADIOACTIVE REFERENCE SOLUTIONS

PRIMARY DILUTION RECERTIFICATION							
MP 009							
<u> </u>							
CURRENT DATE	12/29/2006 0:00						
SOLUTION REFERENCE # Analytics 61680-416 SOLUTION #	Ra-10						
	alf Life, Days						
<sup>228</sup> Ra 5.750E+00	2.100E+03						
Radionuclide 225Ra Reference Date Certified Activity 9.692E-02 uCi	6/4/2001 0:00						
Certified Activity 9.692E-02 μCi Certified Concentration μCi per gram							
prot per grain							
Ampoule /Solution Gross 9.4982 Weight, Grams							
Empty Ampoule 4.4895 Weight, Grams							
Solution Net 5.0087 Weight, Grams							
Total Activity in Ampoule 0.0969 μCl	·						
Observation 10 and 1 and 1							
Chemical Composition of Standard Solution							
<sup>228</sup> Ra(NO <sub>3</sub> ) <sub>2</sub> in 0.5 M HCl							
Dilution Instructions: Dilution Solvent Used 0.	5 M HCl						
U. Diaction Contain Cases	5 M HOI						
Dilute to a volume of 1000.00 milliliters	·						
	_						
Certified Total Activity of 0.0969 µCl Which Equals 2.152E+05 dpm at the date listed above							
And after dilution the activity of this solution is 2 152F+02 dom/mi This activity concentration is based on the original							
And after dilution the activity of this solution is 2.152E+02 dpm/ml This activity concentration is based on the original reference date listed above. All activities are corrected							
	and time of analysis by the laboratory data						
processing	software.						
Expiration Date: D	ecember 29, 2007						
Recertified By Date:	12/29/2006 0:00						
Date.	12/29/2006 0.00						
Verified & Approved By Date:	1/9/07						
QC Approval Child Tolland Date:	110107						
	,						